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VOCATIONAL EDUCATION, A STUDY OF BENEFITS AND COSTS (A CASE STUDY OF WORCHESTER, MASS.).

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THE STUDY WAS MADE TO ASSESS THE ECONOMIC VALUE OF THE VOCATIONAL-TECHNICAL SCHOOL AS AN AREA RESOURCE. A FRAMEWORK FOR ANALYSIS WAS SET UP WHICH TREATED VOCATIONAL EDUCATION AS AN INVESTMENT WHICH COMPETES FOR COMMUNITY FUNDS. DETAILED DESCRIPTIONS WERE MADE OF SUCH INFLUENTIAL FACTORS AS (1) KINDS OF COSTS AND BENEFITS WHICH ACCOMPANY ANY LOCAL INVESTMENT IN EDUCATION WITH PARTICULAR ATTENTION TO VOCATIONAL EDUCATION, (2) INSTITUTIONAL SETTING OF THE PROGRAM SELECTED FOR STUDY, AND (3) TOTAL RESOURCE COSTS OF VARIOUS VOCATIONAL PROGRAMS. DATA GATHERED WERE ANALYZED TO DETERMINE THE VALUE OF THE VOCATIONAL HIGH SCHOOL AND POST-HIGH SCHOOL VOCATIONAL SCHOOL AS A MEANS TO (1) PREVENT DROPPING OUT, (2) INCREASE LIFETIME EARNINGS, (3) INCREASE GEOGRAPHIC MOBILITY OF GRADUATES, AND (4) INCREASE INTERGENERATIONAL MOVEMENT OF WORKERS. CONTRIBUTIONS OF THE SCHOOLS WERE MARGINAL IN THE FIRST THREE AREAS AND ONLY RELATIVELY SUCCESSFUL IN THE FOURTH. (AL)

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Vocational Education,

A Study of Benefits and Costs,

[A Case Study of Worcester, Mass.]

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Preface

This work is a case study of one community high school system with a view to presenting an over-all economic evaluation of the vocational schools within that system. The study attempts to assess the economic benefits of the vocational school to the individual graduate and to the local community, and to compare these with the direct, indirect and opportunity costs of maintaining the school. In order to accomplish this objective, the study compares the system's regular high schools with its vocational high schools, giving particular attention to the relative cost of the two types of education.

Much more detailed study is devoted to the vocational schools. A class of students at the vocational schools is traced through four years of training and subsequent placement on jobs after graduation.

The starting salaries of vocational school graduates are compared with the starting salaries of those hired directly from regular high school or at the gate. Further, for a sample of firms within the manufacturing sector, the type of entry level job open to vocational graduates is compared with the type of job open to regular high school graduates. Finally, the actual job experience of a sample of vocational graduates during the first eighteen months after graduation, is presented in order to ascertain the extent to which vocational training is utilized.

The study could never have been accomplished without the complete cooperation of the public school officials in Worcester, Massachusetts. I am grateful to all of them for their help, and especially to Dr. John Davis, Superintendent of Schools; Mr. Walter Dennen, Director of Boys' Trade School; and Miss Blanche Penn, Director of The David Hall Fanning School for Girls.

I wish to give special thanks to Professor Frederick Harbison and Professor Richard Lester of Princeton University. The final form of this study benefited greatly from their critical evaluation of an earlier draft and their continuing comments and suggestions.

All of the services of the Industrial Relations Section at Princeton University were most generously put at my disposal by Professor Harbison, its Director. The secretarial staff of the Section could not have been more cooperative.

The author accepts responsibility for the final form of this study but wishes to express gratitude for the assistance of The Office of Education, Department of Health, Education and Welfare. That office provided the funds which made possible the completion of this research.

Arthur J. Corazzini

Chapter I

INTRODUCTION

Vocational education programs in the United States serve many functions and yet, to date, no attempt has been made to assess quantitatively the value of the vocational-technical school as an area resource. The economic aspects of vocational education demand much closer examination and assessment than they have heretofore received, since federal grants to states for the expansion of vocational-technical education are made on the assumption that growth of these public training centers will help minimize unemployment and maximize economic growth within regions and for the country as a whole.

Such an examination and assessment will be the central objective of this study. The economic evaluation of one vocational-technical school system will be carried out in a cost-benefit framework, calculating the economic benefits of the system to the individual graduate and to the community, and comparing these benefits with the total resource costs of maintaining the school.

What is meant by an economic cost or an economic benefit must be clarified, and those variables which enter the evaluation on the cost or the benefit side, clearly defined.

Resources committed to education are an investment in human capital. The economic returns to this investment will be divided into three categories: (1) measurable returns to the individual; (2) measurable returns to the society at large; (3) non-measurable returns to the individual and to society. These returns will be further divided into two sub-categories: a) direct, b) external. The first category, measurable returns to the individual, are those increases in life-time income attributable to the public investment in education. These returns, called private benefits, are measured by calculating the difference in lifetime income between those students completing a given number of years of schooling and those completing one year[1] in addition to the given number. Thus the direct, measurable private benefit of completing high school would be the additional lifetime income of the individual who completes the twelfth school year as compared with one who completes only the eleventh year. There could be an additional private benefit in choosing to spend that year in a vocational school. This would be the increase in lifetime income which was the result of graduating from vocational school rather than from regular high school.

Direct measurable returns to the society at large are worker productivity gains which are reflected in increased personal income. Thus differential lifetime incomes between groups of individuals completing different numbers of years of education can be taken as a partial measure of both private and social benefits. The increased income is the direct, individual private benefit, and reflects the direct social benefits of increased worker productivity.

Clearly, there could be gains in worker productivity which were the result of extended education, but which did not result in increased earnings. This would be the case in any but a perfectly competitive world where the marginal product of labor must equal its wage. Further, there could be increases in lifetime income without increases in lifetime earnings. Finally, differences in lifetime income among individuals who have completed different numbers of years of education, can be only partially explained by these differences in extent of education.[2]

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[1] On the problem of measuring the marginal return to education see H. S. Houthakker, "Education and Income," Review of Economics and Statistics, XLI (February 1959), pp. 24-28; H. P. Miller, "Annual and Lifetime Income in Relation to Education," American Economic Review, L (December 1960), pp. 962-86; W. L. Hanson, "Total and Private Rates of Return on Investment in Schooling," Journal of Political Economy, LXXI (April 1963), pp. 128-40.

Some private and social returns involve explicit financial payment; others do not. Some benefits are internal to a particular decision maker; others are external to a particular decision maker or group of decision makers.[3] Many private and social benefits which are external to any particular decision maker are virtually non-measurable. For example, external benefits of education such as better management employee relations or increased political awareness are not easily measurable. Whether or not the external benefit is measurable, its essential feature is that it cannot be quantitatively apportioned to an individual or to any sub-group of individuals within the community.

There are certain external benefits which can be estimated, as, for instance, the possible effect of added years of education on the unemployment rate. To the extent that an extra year of education reduced unemployment and generated increased income, it would decrease the costs of total welfare and unemployment compensation and, on the income side, increase the total tax take. Further, reductions in the cost of crime prevention might be counted as an external social benefit of the added education, assuming that direct welfare benefits decrease if unemployment is reduced and that people are more law-abiding when they are employed. To be sure, the savings in actual monies spent on social services are but a measure of the economic benefits accruing to the community as a whole; there is no implication that the total increment in social welfare can be measured by these cost savings or increases in tax take. In any case, these external social benefits, as we have described them, must somehow be weighed in any over-all evaluation of a particular investment in education.

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[2] For a complete discussion of these issues see B. A. Weisbrod, "Preventing High School Dropouts", in R. Dorfman (ed.), Measuring Benefits of Government Investments (Washington, D.C.: The Brookings Institution, 1965), p. 117.

[3] See *ibid.* and also Weisbrod, External Benefits of Public Education: An Economic Analysis, (Princeton, New Jersey: Industrial Relations Section, Princeton University, 1964.)

It has been indicated that the economic returns to the investment in education divide themselves into private and social returns, called private and social benefits. These benefits have been classified into direct or internal benefits, and external benefits. Direct benefits were seen to be measurable. It was claimed that some external benefits are, for all practical purposes, immeasurable, while others are measurable.

Obviously, the aforementioned categories of economic returns must be measured against the costs of the investment. Economic costs will be taken to mean those resources, human and non-human, expended in the production of a given good or service, and the economic value of those resources will be measured in a standard monetary unit of account. Thus, computing the total resource costs of the vocational or any other educational program will mean computing the economic value of all resources expended in the production of the public good.

For the purposes of this evaluation, costs, like benefits, will be divided into three main categories: 1) measurable private costs; 2) measurable social costs; 3) non-measurable private and social costs. Measurable private and social costs will be further divided into three sub-categories: a) direct, b) implicit, c) opportunity.[4]

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[4] 4. A full analysis of measurable private and social costs can be found in T. Schultz, "Capital Formation by Education," Journal of Political Economy, Vol. LXVIII (1960), p. 575; F. Machlup, The Production and Distribution of Knowledge in the United States, (Princeton, New Jersey: Princeton University Press, 1962), p. 100.

Direct, measurable private costs are those current expenditures which are incurred by and chargeable to the individual student. Such items as clothing and school supplies constitute the bulk of such expenditures. There are no measurable, implicit private costs. There are, however, private opportunity costs which are measurable. In this situation, measurable opportunity costs are the foregone earnings of students who choose to continue education rather than enter the labor market. They are estimated by calculating what such a student would have earned during the relevant time period, had he chosen to seek employment.

Direct, measurable social costs are those current and capital expenditures which are incurred by the public authorities in the running of the school system. Teachers' salaries, books and equipment, maintenance of buildings and school yards are the most important of these direct cost items.

Implicit social costs include tax losses suffered by the community because of its investment in school facilities, as well as depreciation charges on school buildings, grounds and equipment. Though these capital charges can be readily estimated, they are usually omitted by public authorities calculating the annual amount of the public investment, with the results that total resource costs are seriously underestimated. Social opportunity costs are those costs which are the result of allocating public funds in a given manner rather than in another more nearly socially optimal way. Obviously, unless one can calculate the difference in social welfare between the two situations, no empirical measure of social opportunity costs can be made.

Perhaps the best way of illustrating the concept of social opportunity costs is to distinguish between these costs and private opportunity costs. For the individual, the opportunity costs in choosing the vocational training program are, in part, the measured foregone earnings already discussed. For our purposes, these foregone earnings are the same as those of any other youth of high school age who chooses to remain in school. The other possible private opportunity costs which could result from choosing the vocational program would be the total losses in lifetime income suffered by the individual who chose this program rather than any other high school program.

In part, the social opportunity costs would be these same income losses, aggregated for all individuals and counted as income losses to the society. In the discussion of benefits, it was stated that, with qualifications, income gains measured productivity gains. Now, in a similar manner and with similar qualifications, income losses measure productivity losses. In addition to these productivity losses, social opportunity costs would include all of the necessitated increases in welfare payments or crime prevention costs or decreases in tax take, which the society would suffer as a result of having allocated its funds in this manner.

Before the discussion of ways of comparing the costs and benefits described, an externality[5] which involves both costs and returns, must be considered. This externality differs fundamentally from the concept of external benefit previously discussed and is directly related to the geographic mobility of people.

The actual movement of people into or out of a given community affects the composition of the human capital living within that community. Moreover, the movement out of the community also affects the composition of the human capital in the surrounding communities.

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[5] See B. A. Weisbrod, External Benefits of Public Education: An Economic Analysis, pp. 40-68.

If a given community has a high percentage of people with low levels of educational attainment, by encouraging out-migration it can impose social costs on the surrounding communities. For example, if it is assumed that high school dropouts are more likely than high school graduates to be involved in crime or to become poverty cases, a community could save the welfare and crime prevention costs by encouraging out-migration of these individuals. To be sure, the process would result in the imposition of these costs on the surrounding communities.

On the other hand, a community may lose people with high levels of educational attainment through the same migratory movement. Indeed, it is possible that a community which expends large amounts of public funds on education will actually increase the probability of its graduates' migrating, as a result of the wider job opportunities and further desire for education which a superior public school system promotes. Moreover, because of this geographic mobility, the same number of years of different kinds of education may make very different contributions to a particular region's economic growth. Regular high schools may graduate large numbers of students who migrate out of the area for college and eventual employment. Thus the local area could lose much of its investment in people. On the other hand, a vocational high school could gear its program to graduating people who would be trained to work in local industry and who would remain in the local region.

Insofar as the vocational high school arrested worker mobility, whatever gains the region enjoyed from this program would be achieved at the expense of other regions. Rather than external benefits, these gains could more appropriately be termed intra-regional transfers. In practice, the forms of this grant-in-aid program could be diverse.

If a group of firms were to set up local industry-specific[6] training programs they, as a group, could capture the benefits of productivity increases in the work force. Ordinarily, because no one firm could capture the benefits of training in an occupation which was area -- or industry-specific, the trainee would have to bear the costs of his on-the-job training in the form of lower wages. In this situation, the vocational school provides public money for the occupational training while the student bears only opportunity costs in the form of his foregone earnings. The firms involved bear no direct costs. However, by structuring what would be general training into area -- and industry-specific training, the firms do gain from increases in worker productivity.

The local firms could make the vocational training area industry-specific in a number of ways. For example, they might indicate the particular kinds of metals the vocational school should use for instructional materials in shop work. They could offer school instructors summer jobs in their firms in order to familiarize them with local shop practices. In some instances general training in the school could be accompanied by industry-specific training on the site of possible eventual employment.

The schools could also make a conscious attempt to place graduates in firms located within the community. In other words, in addition to offering firms a graduate with industry-specific skills, the school could make a positive effort to induce such a graduate to seek local employment. If a school's employment officers adopted such a policy they could indeed influence the placement of graduates.

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[6] For a complete analysis of the relationship between general training, firm-specific training and industry-specific training, as well as a discussion of the relationship between schooling and on-the-job training, see G. Becker, "Investment in Human Capital: A Theoretical Analysis," The Journal of Political Economy Supplement: October 1962, Vol. LXX, No. 5, Part 2; J. Mincer, "On-the-Job Training: Costs, Returns, and Some Implications," The Journal of Political Economy Supplement: October 1962, Vol. LXX, No. 5, Part 2.

Yet another way in which the vocational school could act as a regional grant-in-aid to industry would be to function as an intergenerational retraining center. If, for example, a new firm established itself in a rural area, a vocational school might seek to enroll the sons of farmers and farm workers. The establishment of a permanent vocational high school would be fundamentally different from a short-run retraining program for the rural unemployed. The vocational school would be seeking to establish a permanent alternative to the traditional career choices of the children of a particular group of workers.

From the discussion it is evident that direct private and social benefits, measured by income increments, can be calculated. However, external private and social benefits are, at best, only partially estimable. If we consider costs, we see that direct private and social costs can be estimated. Further, implicit social costs and some private opportunity costs are also measurable. On the other hand, some private opportunity costs and most social opportunity costs cannot be quantitatively estimated. Finally, there are intra-regional transfers which can be estimated and must be considered in any over-all program evaluation.

Therefore, in order to evaluate the vocational program, this regional study will begin with a description of the program, then attempt to measure direct and implicit private and social costs, setting these costs against direct private and social benefits. The resulting cost-benefit ratio will yield a first approximation to an over-all evaluation of the vocational program. An attempt will then be made to consider some of the externalities and intra-regional transfers which affect the benefit stream. The last step will be to consider the opportunity costs which must be added to the other costs of the program before final evaluation is made.

The cost data of the Worcester, Massachusetts high school system will be used. The respective total resource bases for both the regular high schools and the vocational high schools will be compared as will the private and social benefit streams for the two systems. An attempt will be made to set up the conditions which would have to be met if the rates of return to the two high school systems were to be equal. In the first approximations the assumption will be that life-time income streams computed from national census data are applicable to the Worcester community. When consideration is given to external social benefits and to intra-regional transfers, data collected from the school system of the city of Worcester will be employed.

Chapter II

THE INSTITUTIONAL SETTING

The Worcester High School System Vocational Education in the State of Massachusetts and in the City of Worcester

Introduction

The purpose of this Chapter is to describe the institutional setting in the city of Worcester, where the central-cost-benefit analysis of vocational education was made; to reveal, in some detail, the nature of the programs for full-time vocational students; and to compare the vocational schools first with the regular high school system and then with the state-wide vocational school system.

Since the emphasis in this comparative cost and benefit study will be primarily on vocational and regular high schools, evening programs for the worker seeking to upgrade his skills will be dealt with only in so far as they serve to illustrate the wide range of activities undertaken by some vocational schools.

Consideration of the full-time vocational program for high school graduates is also relevant to this study. The programs are administered by the vocational schools, and while they might be designated as Junior College programs, the term is not strictly accurate and so they will be referred to simply as thirteenth and fourteenth grade programs.

The High School System in Worcester

In September of 1963, there were four regular public high schools in Worcester, accommodating 5,756[7] pupils in grades ten through twelve. All of these pupils were residents of the city.

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[7] This statistic was taken from office records of the Worcester Public School system. Unless otherwise noted, all data presented in this chapter is taken from office records of either the regular high schools or the vocational schools.

There were also two vocational schools -- Worcester Boys' Trade School and the David Hall Fanning School For Girls, to be referred to in the ensuing statistical tables simply as Boys' Trade and Girls' Trade, and in the text as Boys' Vocational High School and Girls' Vocational High School. Together, these two schools had a total enrollment of 973 pupils in grades nine through twelve. The student body was drawn from the entire Standard Metropolitan Statistical Area of Greater Worcester. The percentage distribution of enrollees for the 1963-64 school year is shown in Table 1.

The Superintendent of Schools in Worcester had no jurisdiction over the running of the vocational schools; they were administered separately from the regular schools, each having its own Director. Despite this separate administration, the schools were necessarily related in a number of ways. Actually, the vocational schools drew approximately 66.2% of their high school pupils from the city of Worcester, so that, in effect, the vocational schools were competing with the regular high schools for students because the individual's choice of school had to be made at the ninth grade level.

In September of 1963 a prospective student of regular high school had four possible choices: Commerce High, the Commercial school, offering programs in business education; Classical High, the college preparatory school; North High and South High, both schools providing for students who had not decided on business, vocational or college preparatory programs. A fifth high school, newly built but not then operating, planned to offer all programs except the vocational.

The regular high schools in Worcester are under completely local control. The vocational schools, although also under local control, have close ties with the State Department of Education. There are several reasons

Table 1

Geographic Distribution of Students Enrolled at Worcester Boys' Trade[a] and David Hall Fanning School for Girls

	Boys' Trade	Girls'Trade
Students Residing Outside the City of Worcester but in the Standard Metropolitan Statistical Area	287	162
Students Residing in Worcester	587	305
Total Students[b]	874	467
Percent Out of Town	32.84%	34.69%
Percent Worcester	67.16%	65.31%

Source: School records of Worcester Boys' Trade.

a. This tabulation did not separate those students who attended the Girls' or Boys' Trade from those who attended post-high school 13th or 14th grade.

b. These totals, gathered during the 1962 school year, differ slightly from totals presented later in this report. The latter totals are based on enrollments as of September 1, 1963.

for this close association, chief among them being the fact that federal monies are sent to the states under provisions of federal law supporting vocational education. The Vocation Division of the State Department of Education takes this money, adds state funds to it, and pays the local schools a percentage of the expenses incurred in conducting training programs. Another division of the State Department of Education performs the same function for regular high schools but with an important difference. Whereas the regular high schools receive their funds in the form of a general grant for expenses incurred, the vocational school receives money only for support of those training programs for which the federal legislation specifies support shall be given. As a result, the Worcester vocational schools do not offer any training programs for which they would not receive federal and state financial help. Their programs are really only a small part of a larger state-wide program of training. This can best be seen if the state-wide program and the Worcester program are juxtaposed.

The Vocational Program in the State as a Whole

Vocational education in the Commonwealth of Massachusetts is under the general control of the Division of Vocational Education of the State Department of Education. The total program includes day courses, evening programs, full and part-time programs. In 1962-63 total enrollment in all full-time programs was 19,422,[8] of this number, only 1,082 were in technical programs which required a high school diploma for entrance, and about 1200 were in cooperative programs which begin in the eleventh or twelfth grade; the remainder were in four year programs which begin at the ninth grade level. During this same 1962-63 school year, 52,592 people were enrolled in evening programs. Table 2 is a summary of the distribution of these day and evening student enrollments, classified by occupational fields.

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[8] Quality Education for Massachusetts an Investment in the People of the Commonwealth, Final Report of the Special Commission Relative to Improving and Extending Educational Facilities in the Commonwealth, Hon. K. Harrington, Chairman, House No. 4300 (June 1965), p. 260. All State statistics are taken from this report.

Table 2

State-wide Enrollments in Day and Evening Vocational Education Programs, 1962-63

Training Programs	Day Enrollment	Evening Enrollment
Industrial occupations	14,478	9,983
Technical occupations	634	932
Practical nursing and health	752	224
Agriculture	1,137	294
Home economics	2,019	39,641
Distributive occupations	402	1,518
Totals	19,422	52,592

Source: Quality Education for Massachusetts, An Investment in the Commonwealth. Final Report of the Special Commission Relative to Improving and Extending Educational Facilities in the Commonwealth, Hon. K. Harrington, Chairman, House No. 4300 (June 1965), p. 261.

The industrial occupation programs in the state were by far the most important of the full-time day training programs. Inspection of Table 2 reveals that 14,478 students, or about 75% of the total day enrollment, were involved in such programs. These programs are primarily in the skilled trades. They were offered in 54 day industrial schools for boys, in the industrial departments of seven Boston high schools, and in six industrial schools for girls. The boys' industrial schools operated independently from the regular public high schools and offered a total of 29 different training programs. The maximum enrollment in these schools was 1,265 students, the minimum 19 students, and the median 142 students. Auto repair was the most frequent training program offering, with 45 of the 54 schools including it in their program.

The day industrial schools for girls enrolled 962 students in 1962-63 and like the boys' schools, they operated independently from the public high schools. Most enrollments were in beauty culture, food trades and needle trades.

In 1962-63 there were 14 boys' industrial schools which were also training industrial technicians. 634 students, the total enrollment, could choose from among ten different program offerings. Electronics was the favorite selection of these students, with 208, or about 53%, enrolled in the program.

There were 12 day industrial schools offering four programs for the training of practical nurses, dental assistants, medical assistants and surgical technicians, respectively. Of the total enrollment of 752 students, 611 were enrolled in practical nursing.

Agricultural training programs were offered in five agricultural high schools and in the agricultural departments of 14 regular high schools. The five agricultural schools enrolled 720 students and the regular high schools, 417 -- a state-wide total of 1,137.

There were 740 students enrolled in independent household arts schools. Another 1,279 were enrolled in the household arts department of regular high schools.

Finally, there were 402 students -- 370 of whom were high school seniors -- enrolled in distributive education programs which were offered in 19 high schools and were primarily concerned with retail selling.

The Worcester vocational program was an important part of this statewide venture, as the following detailed account will illustrate.

The Vocational Program in Worcester

In September, 1959, the Worcester Boys' Vocational High School had a total enrollment of 980. (The Girls' Vocational High School enrollment for 1959 was not available.) In September of 1964 the Boys' School had an enrollment of 631 while the Girls' School had an enrollment of 342. The Boys' Vocational High had experienced a 35% decline in total enrollment, to be explained by reference to the enrollment figures for the Worcester Industrial Technical Institute. These reveal that total enrollment for the combined Boys' Vocational High and Worcester Industrial Technical Institute[9] declined only 12% -- from 980 in 1959 to 865 in 1964.[10] The decline in Boys' Vocational High enrollments is actually a shift in the age distribution of those choosing training programs. With the introduction of WITI in 1960, more people were induced to seek training after having graduated from high school. Faced by a facility constraint, school authorities nonetheless chose to allow the enrollment of WITI to increase and thereby decreased the number of spaces available for high school vocational students.

At Boys' Vocational High, 631 pupils were enrolled in 11 separate training programs and at Girls' Vocational 342 had enrolled in eight separate training programs. In Table 3 we have listed the 11 courses offered in the Boys' Vocational High and the enrollments in each over a five-year period.

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[9] The Worcester Industrial Technical Institute will be referred to henceforth as WITI. The Institute is actually the 13th and 14th grade technical school for those students who already have high school diplomas.

[10] For the five year period 1959-64 total enrollments for Boys' Trade and WITI combined were: 1959-60, 980; 1960-61, 950; 1961-62, 941; 1962-63, 927; 1963-64, 865.

Table 3

Enrollments -- Boys' Trade 1959-64

Training Programs	1959-60	1960-61	1961-62	1962-63	1963-64
Auto Repairs	140	120	122	109	86
Cabinet Making	71	62	56	42	49
Carpentry	88	77	61	58	63
Electrical Shop	137	114	101	81	68
Machine Shop	248	219	207	191	165
Painting & Decorating	52	51	49	48	35
Pattern Making	39	27	31	24	23
Plumbing	50	47	46	31	37
Printing	64	52	57	45	44
Sheet Metal	36	33	34	25	26
Welding	51	148	43	43	35
Totals	980	840	807	697	631

Source: Office records Worcester Boys' Trade.

(It is clear from Table 3 that total enrollments in each of the trade courses have declined markedly since 1959. In 1962-63 school officials followed a policy of counting as members of Boys' Vocational High all WITI students who were enrolled in these 11 trade courses. There 102 such students and it was possible to separate them statistically from the high school trade students. However, it was not possible to discover from school officials or from data provided whether this policy was used in 1960-62. It is certain, in any case, that the 1959-60 enrollment figure is for a year prior to the opening of WITI. Approximately 100 pupils in each of the years 1960-61 and 1961-62 could have been counted as Boys' Vocational High students because they were enrolled in the 11 trade courses rather than in the four technical courses. In such a case, the enrollment shift from vocational high school to post high school was not as gradual as first indicated.)

Auto repair, machine shop and electrical shop have been by far the most popular of the trade offerings. In 1959-60, 54% of the total Trade School enrollment was concentrated in these three courses. In 1963-64, these same three offerings accounted for about 50% of school enrollment

The Girls' Vocational High School does not break its enrollment figures down into specific trade courses. It does divide its total enrollment into Trade, Household Arts, Day Practical Nursing, Evening Practical Nursing, Evening Practical Arts. The Trade division has within it courses in the needle trades, beauty culture, food trades and printing. Household Arts is a program of sewing, cooking and general housekeeping. Evening Practical Arts is a rather loose assortment of courses and programs in a variety of areas ranging from needlecraft to Christmas decorating. There are courses designed for people who hope to interest themselves in one or more domestic hobbies. Total enrollment in each program area over a three year period is included in Table 4.

The Evening Practical Nursing program was completely dropped in September 1963. Enrollments in the Trade and Household Arts programs remained almost frozen over the three-year period. However, there was a noticeable increase in enrollments in the Day Practical Nursing Program. Its enrollments

Table 4

Enrollments -- Girls' Trade 1961-64

	1961-62	1962-63	1963-64
Trade	244	257	254
Household Arts	88	89	88
Sub Total	332	346	342
Day Practical Nursing	86	122	120
Evening Practical Nursing	78	48	---
Evening Practical Arts	1125	1237	1099
Totals	1621	1753	1461

Source: Office records, David Hall Fanning School for Girls.

jumped from 86 in 1961-62 to 122 in 1962-63 and then remained at that level in 1963-64. It is not possible to tell from the data whether the corresponding drop in Evening Practical Nursing enrollments from 78 in 1961-62 to 48 in 1962-63 and then to zero in 1963-64 was the result of a policy decision to change one or more evening offerings to day offerings. Evening programs, which do not result in degrees, and the Practical Nursing course, which is in part technical and in some cases requires a high school diploma for entrance, will not be included in references to Girls' Vocational High School but will be treated separately.

The Boys' Vocational School strongly urges all prospective trade students to seek entrance to the school at the end of the eighth grade. Students residing in Worcester are selected on the basis of achievement and aptitude test results and their academic record in the school last attended. Students residing out of town must fulfill the same requirements and are admitted as long as there is room for them without crowding out local pupils. The State asks that no pupil with an IQ below 90 be admitted, though the school may make exceptions in special circumstances.

Each person entering the school is allowed to select the trade area which interests him. Since students are requested to transfer to the vocational school at the ninth grade level, the implication is that a fourteen-year-older's career preference determines his type of job training. The school does permit an individual to try another trade area if at the end of six months, in the judgment of the instructor, he has not made satisfactory progress in the area of his first choice.

But, given the young age of those making a choice it appears that the school counselor is necessarily very important in determining who chooses the vocational school.

Students enrolling in a given trade course in the ninth grade follow a carefully laid-out four-year program. The first year of such a program involves the individual in shop work and a related shop-oriented curriculum of a necessarily elementary nature. He then proceeds to successively more complex shop projects and advanced shop-related classroom work. Basic academic courses are provided concurrently.

The high costs of capital equipment necessary for advanced training leads to some difficult problems. Whereas the ninth grade student is easily accommodated, the eleventh and twelfth graders must share much more limited facilities. For example since the school finds it relatively easy to provide every ninth grade pupil with his own set of type, the ninth grader learning the printing trade would spend most of his shop time setting up type by hand.

On the other hand, the twelfth grader must spend time operating a linotype machine, but the school cannot provide a machine for each student, and hence the students must share the one or two machines available.

In addition to their regular course work, the students provide several important economic services in the form of maintenance work within the school. The interior of the school has been repainted by students in the painting and decorating program. Its main administrative offices were modernized and enlarged by students in the carpentry and electricity programs. The machine shop is regularly serviced by the other trade shops. For example, a broken machine part would be replaced by the combined efforts of pattern makers, welders and machinists.

In some cases citizens contract with individual trade work shops in the school where work performed by the students may vary from manufacture of a set of chairs to rebuilding an automobile engine. The citizen is charged a mere 10% above the cost of materials.

These various activities augment the students' total training program and give the instructional staff additional information with which to rate the students' trade abilities. Formal grades and informal reports are transmitted to the guidance officer, who is actually a type of employment officer. He generally spends one day per week out of the school office in search of current employment opportunities in the local labor market. He then sends graduates to prospective employers for the customary job interview and attempts to keep track of the results of such interviews, recording the placement of all graduates. The system of job placement is not formalized, however, and there can be several alternative methods of placement.

Employers report that their contacts are more often with the shop instructor than with the guidance officer. Calls to the school for prospective employees can be directed to any of the several school officials or teachers who come in contact with students who may meet the employers' requirements. In addition, many of the teachers spend summers in the employ of local firms. Some are former shop workers who have become school instructors. In any case, individual firms are likely to have personal contacts within the school and rely on these contacts rather than on any formal placement system.

The Girls' Vocational High School is organized and administered along the same lines as the Boys' Vocational, and admission requirements are the same. The four year program is comprised of trade work, trade-related class work and regular academic work. There is a greater amount of program shifting at the Girls' Vocational, largely because the hairstyling program is a favorite. But state law specifies that all trainees in this program be at least sixteen years of age, with the result that many girls enroll in the school at the ninth grade level and transfer from other trade programs to the hairstyling program when they reach their sixteenth birthday.

The students at the Girls' Vocational High are also required to offer their services to the school. They operate their own cafeteria, where all cooking and serving of meals is done by students enrolled in the household arts and food programs. Likewise, students in the dressmaking department contract with local citizens for the making of clothes.

The most important difference in the operations of the two schools lies in the separate methods of guidance and job placement. Whereas the Boys' Vocational officially has a full-time employment officer in the person of the guidance director, the Girls' Vocational divides the guidance and placement duties among the heads of departments. The informal contacts between shop teachers and employers which arise in the Boys' Vocational become, in the Girls' Vocational, the legitimate process of employer contact.

The Area Technical School Program in Worcester

The Worcester Industrial Technical Institute had a total enrollment of 230 pupils in September of 1962. The enrollment in September of 1963 was 234 pupils. For the reason explained above, the school could not supply total enrollment figures for the first three years of its operation.

The 234 pupils enrolled in WITI in September of 1963 chose from among 15 training programs offered. These included 11 programs offered to the vocational high school students and four additional programs open only to WITI pupils. The training programs offered and the numbers enrolled in each one are shown for the 1962-63 and 1963-64 school years in Table 5 below.

Table 5
Enrollments -- WITI 1962-64

	1962-63	1963-64
Auto	16	27
Cabinet Making	7	3
Carpentry	6	9
Electrical Shop	10	10
Machine Shop	21	23
Painting and Decorating	5	5
Pattern making	4	2
Plumbing	9	8
Printing	13	14
Sheet Metal	6	5
Welding	5	7
Drafting	63	60
Electronics	26	30
Mechanical Technology	30	20
Metals Technology	9	11
Totals	230	234

Source: Office records, Worcester Boys' Trade.

In all, the 11 trade courses had an enrollment of 102 in 1962-63 and 113 in 1963-64; that is 44% of those enrolled as WITI students in 1962-63 were in one of the 11 trade courses offered high school students and in 1963-64, 48% of all WITI students were in these trade courses.

The most popular of the training programs at WITI was drafting. This is evident from inspection of Table 5. There were 60 students enrolled in this course in 1963-64, twice the number enrolled in electronics, the next most popular offering.

The selection of students follows the same basic procedures already outlined for Boys' Vocational and Girls' Vocational High Schools.

Data which describes the general geographic distribution of the student body at WITI has already been presented. In addition, it is of some interest to know from what high schools they have graduated. Some approximate answer can be gained by referring to a sample of 74 of the 90 students who graduated from WITI in 1964. The sample reveals that 5.4% of them were previous graduates of Boys' Vocational High School. Graduates of the regular high schools in Worcester accounted for 32.4%; graduates of the Catholic high schools accounted for 20.2%; and graduates from regular high schools outside the city accounted for 42%. We cannot identify the high school programs of this 42% but we can identify the original programs of the 32.4% who attended Worcester high schools. 6.7% from the college preparatory program,23% from the general program and 2.7% from the commercial program comprise the total 32.4%.

Having entered the school, the student is exposed to the same kind of training program as that of the vocational high school, with one important difference: WITI students do not take any strictly academic work and therefore they complete their training in two years.

The students' contribution to the work performed for the school -- school renovations or shop repairs -- is the same as that of the vocational high school students. Their progress is recorded and transmitted to the school guidance director, and procedures for job placement follow. In most cases, employers who hire vocational high school students also hire WITI students. Except for the graduates of the drafting program, little distinction is made by school officials between WITI graduates and vocational high school graduates.

This, in its essentials for the present study, describes the vocational training program in Worcester, Massachusetts. What are the costs of this training program relative to the costs of regular high school education? It is to a consideration of this vital question that we turn in the next chapter.

Chapter III
THE COSTS

The Total Direct and Implicit Costs for Worcester Boys' Trade, WITI, David Hall Fanning School for Girls, The Regular High Schools. The Sources of Cost Differences.

Introduction

The first step in an empirical evaluation of the Worcester vocational education programs is to calculate the cost of the city's investment in its entire high school educational system. This calculation will involve computing the investment in WITI, the thirteenth and fourteenth grade technical school, as well as the investment in the thirteenth and fourteenth grade Practical Nursing program, conducted at the Girls' Vocational High School.

The purpose of the evaluation is to measure the total private direct and the total public direct and implicit allocation of resources to the community high school system, in order to ascertain whether vocational high school education is relatively more expensive than regular high school education. Should it appear relatively more expensive, the answers to three further questions will be sought. First, how many units of regular high school education could be bought for one unit of vocational high school education? Second, what are the specific reasons for the cost differences in the two systems of education? Third, what is the cost of high school-level training relative to post high school training? To answer this last question the costs of the WITI program will be computed and then compared with the costs of high school vocational programs.

The estimates in this study will not include private or public opportunity costs; these will be reserved for another part of the study. We begin here with public direct costs.

Public Direct Costs

During the 1963-64 school year the total amount expended, on current account, for the education of public school children in Worcester was $15,206,550, approximately one third of the city's total budget for the same fiscal year. Of this total $2,608,228 went to support the four regular high schools and $1,024,953, the two vocational schools.

Over the five-year period of 1959-64, direct public expenditures, on current account, for the four regular high schools, grew from approximately $1,900,000 to approximately $2,600,000. This represents an approximate 37% increase in the expenditure level. During this same five-year period, expenditures for the Boys' Vocational High School grew by about 25%; expenditures at Girls' Vocational grew by a corresponding 25%.

As mentioned in the preceding chapter, there are several problems connected with the study of the enrollment data of both Boys' and Girls' Vocational High and, since per pupil costs are being calculated, these problems carry over into the present chapter. The total current cost figures for Boys' Vocational are a recording of the monies expended in support of 1073 pupils in grades nine through twelve, and 113 pupils in grades thirteen and fourteen -- the latter pupils being actually members of WITI, though counted by school officials as members of the high school because they had chosen courses which were offered in the ninth through twelfth grade curriculum. They must then be charged a per pupil cost equal to that of the high school students and that total must be subtracted from the Boys' Vocational bill. Further, the separation of WITI costs from Boys' Vocational costs was not efficiently accomplished by vocational school authorities, in fiscal 1964, items which amounted to 21.3% of the total Boys' Vocational expenditures, on current account, were completely omitted in the WITI expenditure sheet.

The Girls' Vocational High School presents problems of a similar nature. There were 20 pupils in the hairdressing training program who already held high school diplomas and whom school authorities did not separate from the rest of the high school group. The assumption will be made that the same amount of money is spent on every pupil who attends the school and the costs of educating this group of hairdressers will be subtracted from the total cost of running the Girls' Vocational High. Similarly, the costs of the thirteenth and fourteenth grade practical nursing programs were separately recorded by school authorities. It is possible that the method of separation was somewhat arbitrary, but the school's estimates of costs will have to be taken as the best approximations to the actual costs.

In computing per pupil costs, the aim is to arrive at a measure of the relative costs of regular and vocational high school training and beyond this, the total amount of community resources committed to vocational training. The vocational high schools are organized on a ninth through twelfth grade basis; the regular high schools, on a tenth through twelfth grade basis. In order to arrive at some measure of the total amount of resources committed to vocational training, the vocational program must be considered a four-year effort. To compute per pupil costs, total four-year enrollment is divided by total four-year costs. However, in order to illustrate just what part of these total costs support tenth through twelfth graders, the costs of educating these pupils must be separated from the costs of educating the ninth graders.

It must be assumed that the vocational school spends as much, per pupil enrolled, on the ninth grade pupils, as it does on the tenth through twelfth graders. If ninth grade education is actually somewhat cheaper, the result will be an underestimation of the costs of educating vocational students in grades ten through twelve.

With these necessary calculations made, Table 6 records the total and per pupil current costs for the 1963-64 school year.

Table 6

Current Costs for Boys' Trade, Girls' Trade and the
Regular High Schools in Worcester
School Year 1963-64

	Total Pupils Enrolled	Current Cost Per Pupil Enrolled	Total Current Costs
Worcester High Schools Grades 10 - 12	5,756	$452.00	$2,608,228
Boys' Trade Grades Grades 10 - 12	497	964.50	479,170
Boys' Trade Grade 9	134	964.50	129,243
Girls' Trade Grades 10 - 12	242	793.00	192,143
Girls' Trade Grade 9	100	793.00	79,300
Totals	6,729	------	$3,488,084

Source: School records of Worcester High Schools, Boys' and Girls' Trade Schools.

Total enrollment in grades ten through twelve for the Boys' and Girls' Vocational Schools, combined, was 739. This figure was about 11% of the total high school enrollment. However, while the vocational high schools held 11% of the total high school enrollment, 20% of the total allocation of funds to the entire high school system went to support vocational education. Obviously, the current cost estimates indicate that high school vocational education is

indeed expensive, relative to regular high school education. These estimates concern only public direct costs; public implicit costs must ultimately be added. Meanwhile, the current cost estimates for WITI and the Practical Nursing Program are presented as the initial step in a comparison of the relative costs of training at the high school and post high school levels.

Earlier, it was mentioned that school authorities had not adequately recorded all of the costs of operating WITI. For example, no charge was entered for janitors' services because the Boys' Vocational accounts included the cost of janitors, and these same janitors serviced both Boys' Vocational and WITI. If a per pupil cost of janitors services is computed, some part of the cost of these shared services can be apportioned to WITI. When the same is done for each of the items omitted from the WITI cost sheet, the total cost to WITI of services received from Boys' Vocation is $35,282 for 1963-64. Including this figure in the computation of per pupil costs, it is found that the current cost per pupil enrolled in the four technical courses, for the 1963-64 school year, was $1093. The total current cost, then, was $132,327 for the same year. These two figures apply only to the four technical courses with a total enrollment of 121. The other 113 WITI students, enrolled in one of the eleven trade courses, are considered to have been trained at a cost of $964.50 per pupil, the same cost as that for the high school trade student. The total current cost for training the total WITI class of 113 trade course students and 121 technical course students is reached by adding the costs for each part of the program.

The current costs of the Practical Nursing Program are computed directly from data compiled by school authorities. The current costs of this program differ markedly from the current costs of all other vocational programs. The

figure of $457 per pupil is almost identical with that of regular high school costs. The reasons for the marked differences in cost will be dealt with later in this chapter. Table 7 presents a summary of enrollments, per pupil costs and total costs on current account, for WITI and for the Practical Nursing Program at Girls' Vocational High.

Table 7

Current Costs for WITI and Practical Nursing Program at Girls' Trade School Year 1963-64

	Total Pupils Enrolled	Current Costs Per Pupil Enrolled	Total Current Costs
WITI - 4 Technical Programs	121	$ 1093	$ 132,327
WITI - 11 Trade Programs	113	964	108,988
Total WITI	234	------	$ 241,315
Practical Nursing at Girls' Trade	120	$ 457	$ 54,867

Source: Office Records of WITI and Girls' Trade.

Public Implicit Costs

To these estimates of current costs implicit public costs must now be added. The analysis is based on the work of T. Schultz[11] and F. Machlup.[12] Following Schultz, in computing comparative per pupil costs, yearly outlays for new plants and equipment have been omitted. The per pupil costs deal only with current account items. This is done in order to avoid wide variations in per pupil costs which would be due solely to the large capital outlays which occur only at infrequent intervals. However, implicit rent and capital charges and a property tax loss estimate can be added to these per pupil items.

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[11] Ibid., Introduction P. 6.

[12] Ibid., Introduction P. 6.

Schultz estimates the implicit rent on buildings, grounds and equipment as 8% of the book value of this physical property. His estimate assumes no depreciation or obsolescence on land but 2% per annum on buildings and improvements and 10% per annum on the value of equipment. Further, 15% of the value of physical property is attributed to land, 15% is attributed to equipment and 70% to buildings and improvements. The interest rate is assumed to be 5.1%; thus for $100 of assets:

Interest charge 5.1% = $ 5.10
Depreciation and Obsolescence
a) Buildings and Improvements
70% x 2% = $ 1.40
b) Equipment 10% x 15% = 1.50
$ 8.00 = 8%

In the present estimate, the Schultz 5.1% interest charge per annum will be applied to the full fair market value of physical property. The 2% per annum depreciation rate on buildings will be maintained. This depreciation rate will be applied to the estimated replacement costs of school buildings. Replacements costs will be computed by using the average per pupil cost for new school buildings erected during the 1963-64 fiscal year. The 10% straight line depreciation method using the replacement costs of equipment is employed to calculate an obsolescence charge.

Replacement costs for new buildings and equipment are used because school inventory sheets cannot be utilized in estimating depreciation charges. The schools recorded all purchases of equipment in current dollars at the time of purchase. Moreover, the buildings are not new and the currently assessed valuation of them is an estimate for structures 30 or more years old. The Schultz estimate of a 50-year life span for buildings was based on a nationwide sample of school buildings and represented an average expected life span for the national stock of school buildings. Since the specific situation of Worcester is being dealt with, the best procedure appears to be to estimate the replacement costs of the school buildings under consideration, then to assign a 50-year expected life span to these hypothetical new school buildings and depreciate them at a rate of 2% per annum. The estimate of replacement costs is based on a sample of new schools constructed in the state of Massachusetts during the 1963-64 fiscal year. Costs per pupil were computed for sub-samples of vocational high schools and regular high schools. The average per pupil cost for new equipment and the average per pupil cost for new buildings was next computed. These per pupil costs were then related to the size of the Worcester vocational and regular high school enrollments in order to arrive at the final estimate.

The depreciation charge is higher than it would be if the 2% per annum rate had been applied to the listed book value of school buildings in Worcester. However, the 2% rate assumes a 50-year life span, certainly much longer than the expected life span of the current buildings.

Finally, the vocational school calculation will employ different weights, 67% of total value being attributed to buildings, 25% to equipment and 8% to land. For $100 of assets the vocational school calculation takes this form:

Interest Charge 5.1% = $5.10

Depreciation and Obsolescence (using replacement costs)

a) Buildings and Improvements

67% x 2% = 1.34

b) Equipment

10% x 25% = 2.50

$8.94 = 8.94%

For the regular high schools, the charge of 8% is maintained, with the only change being the use of replacements costs for depreciation charge estimates.

Property tax losses are computed by applying the present Worcester property tax rate, in full value terms, to the full fair market value of school buildings and grounds. This full market value is computed by the city, which uses procedures of the Massachusetts State Department of Corporations and Taxation. The Worcester property tax rate in 1964 was $53 per thousand. (Note that if enough of a city's taxable property is tax-exempt, this computation would over-estimate tax losses because inclusion of this property would, to some extent, reduce the tax rate for a given level of expenditures.) For the school and fiscal year 1963-64, our computations yield the following results:

Table 8

Total Implicit Rent and Tax Exemption Costs for Worcester High Schools, Boys' Trade, Girls' Trade.

	Worcester High Schools	Boys' Trade	Girls' Trade	Total Trade
Implicit Rent	$ 341,870	$ 142,925	$ 60,646	$ 203,571
Cost of Tax Exemptions	121,900	70,596	25,175	95,771

Sources: 1) City of Worcester, Office of the Assessor.
2) Office Records, Vocational and regular High Schools.
3) Mass. State Department of Education - Department of School Building Assistance.

The costs listed in Table 8 are total costs for each school or group of schools considered. Thus the implicit rent charge of $341,870 is the total for all four high schools. The Boys' Vocational costs include WITI. The Girls' Vocational costs include the Practical Nursing programs. Therefore, a per pupil cost will be computed in every case and the respective school enrollments will be used to apportion these costs. It is assumed that every individual attending full-time day school in grades nine through fourteen shares in these costs. We do not include MDTA enrollees or evening school students. In Table 9, below, the results of these calculations are recorded.

Table 9

Total and Per Pupil Implicit Rent and Tax Exemption Costs for
Worcester High Schools, Boys' Trade, Girls' Trade,
WITI, Practical Nursing

Worcester High Schools

	Total Costs	Cost Per Pupil
Implicit Rent	$ 341,870	$ 59.50
Tax Exemptions	121,900	21.00

Boys' Trade School

	Total Costs 9th Grade	Total Cost 10-12th Grade	Total Cost 13 & 14th Grade	Cost Per Pupil
Implicit Rent	$22,000	$ 82,000	$ 38,500	$165
Tax Exemptions	10,850	40,000	19,000	81

Girls' Trade School

	Total Costs 9th Grade	Total Cost 10-12th Grade	Total Cost 13 & 14th Grade	Cost Per Pupil
Implicit Rent	$ 13,000	$ 31,400	$ 15,600	$ 130.00
Tax Exemptions	5,450	13,300	6,450	54.50

Sources:
1) City of Worcester, Office of the Assessor
2) Office Records, Vocational and Regular High Schools
3) Mass. State Dept. of Education, Dept. of School Building Assistance.

The per pupil implicit rent charge in the regular high schools was $59.50 per pupil. The tax exemption cost was $21 per pupil. These costs were considerably lower than the per pupil costs for the vocational schools. The Boys' Vocational High School had an implicit rent charge which totalled $165 per pupil and a tax exemption cost of $81 per pupil. The implicit rent charge was more than 250% of the regular high school charge and the tax exemption cost almost four times that of the regular high schools. Implicit rent at the Girls' Vocational High School was $130 per pupil and the tax exemption charge $54.50 per pupil. Just as in the case of Boys' Vocational, implicit costs at Girls' Vocational were considerably more than those at the regular high schools.

This method of allocating implicit costs points out an important problem. In estimating replacement costs, only the number of pupils enrolled in the ninth through fourteenth grades could be used. This was necessary in so far as new schools are designed to accommodate a core of daytime students. The Worcester Vocational High Schools were not established as MDTA training centers, and while fuller utilization of existing facilities lowers the capital charge to each function, the existence of the core daytime student body is probably a necessary condition for the MDTA and evening programs.

The estimates of implicit costs complete the task of calculating public direct and implicit costs for those Worcester schools being studied. Direct private costs remain to be completed. A summary table of calculations to this point follows.

Table 10

Total Public Per Pupil Costs -- Regular High Schools, Boys' Trade, Girls' Trade, WITI, Practical Nursing at Girls' Trade School Year 1963-64

	Regular High School Cost Per Pupil Enrolled	Boys' Trade Cost Per Pupil	Girls' Trade Cost Per Pupil	WITI Cost Per Pupil	Practical Nursing Cost Per Pupil
Current Costs	$452.00	$964	$793	$1028[a]	$457
Implicit Rent	59.50	165	130	165	130
Property tax loss	21.00	81	54.50	81	54.50
Totals	$532.50	$1210	$977.50	$1274	$641.50

Source:
1) City of Worcester, Office of the Assessor
2) Office records, Vocational and Regular High Schools
3) Mass. State Dept. of Education, Department of School Building Assistance.

a. This estimate of WITI current costs is a simple average of the two cost estimates given earlier. It is an average of the $964 figure which applies to WITI students in the Trade courses and the $1093 estimate which applies to those WITI students in the four technical courses.

Table 10 yields a partial answer to two questions posed at the outset of this chapter. Comparing the public per pupil costs for the regular high schools with those for the vocational high schools, it is clear vocational education is considerably more expensive. The regular high schools spent $532 per pupil while the Boys' and Girls' Vocational High Schools spent respectively, $1210 per pupil and $977 per pupil. The Boys' Vocational costs ran 2.3 times those of the regular high school, while the Girls' Vocational costs were 1.8 times those of the high schools. The total public per pupil costs of WITI were $1274, only $64 per pupil higher than Boys' Vocational costs. The costs of the Practical Nursing Program were $641 per pupil, about one half those of WITI.

It was stated at the outset of this chapter that if vocational education were more expensive than regular high school education, it would be of interest to discover how many units of regular high school education could be bought for one unit of vocational education. The cost ratios listed in Table 10 only partially answer this question. It would appear that 2.3 units of regular high school education could be bought for one unit of Boys' Vocational education. Similarly, 1.8 units of regular high school training could be purchased for one unit of Girls' Vocational education. The actual cost ratio between vocational training and high school education is probably much higher than these 2.3 to 1 or 1.8 to 1 ratios would indicate. It is probably safe to say that a unit of purely vocational training would cost much more than a unit of vocational education which includes elements of regular high school education.

Direct Private Costs

In the ordinary day-to-day life of the school, students must purchase certain necessary goods and services which may include only the minimum of pencils and note paper. In most cases individuals face fairly regular pocket expenses for such items as tickets to athletic events, mid-afternoon snacks or gasoline for automobile transportation. If a student wishes to participate fully in school activities, he may even find it necessary to rent formal clothing for a school dance. An accurate accounting of all such costs would require careful review of the individual budgets of all students enrolled in the Worcester high schools and vocational schools in 1963-64. Needless to day, such an accounting is not feasible. Rather, the methods of T. Schultz, previously employed, will be used again in order to estimate these costs.

Schultz estimates school-related costs to be 5% of income foregone during the school year. If his method for estimating foregone earnings is used and 5% of that figure is taken as an estimate of school-related costs, the total cost to high school students for 1963-64 was $56 per pupil. Income foregone by high school students in 1963-64 was $1120 per pupil and 5% of this figure yields a direct private cost estimate of $56. The same method applied to those attending WITI or the Practical Nursing Program yields a cost estimate of $121 per pupil. The cost estimate of $56 per pupil is added to the public cost estimates for regular high school and the vocational schools. The result is that total public and private direct and implicit costs add to $588 per pupil for the regular high schools, $1266 per pupil for Boys' Vocational High School and $1033 per pupil for Girls' Vocational High School. The private cost estimate of $121 per pupil for those attending WITI or the Practical Nursing Program, brings these total costs to $1395 per pupil for WITI and $762 per pupil for Practical Nursing.

If total private direct cost are added to the costs for regular and vocational high schools, then it is found that Boys' Vocational is 2.15 times as expensive as regular high school and Girls' Vocational is 1.75 times as expensive. WITI costs are now $129 per pupil higher than Boys' Vocational costs and the Practical Nursing Program is now 55% as expensive as WITI programs.

The Sources of Cost Differences

The next step in this study of costs is to seek some explanation for the fact that high school education at both Boys' Vocational and Girls' Vocational is considerably more expensive than regular high school education and the cost of Practical Nursing programs is far below those of any other vocational training program. Table 11 contains a complete summary of all current expenditures for the 1963-64 school year for the regular high schools, Boys' Vocational High and Girls' Vocational High.

Considering only the 1963-64 academic year, we place the regular High School budget alongside that of the Boys' and Girls' Vocational Schools. The allocation of funds within the various school functions is remarkably similar. The Boys' Vocational School devoted 62.7% of its budget to teachers' salaries and 77.9% to wages and salaries in total. The Girls' Vocational School allocated 72% of its budget to teachers' salaries and 86.2% to wages and salaries in total. The regular high schools devoted 63% of their budget to teachers' salaries and 84.2% to wages and salaries in all. The difference between the systems lay in the emphasis placed on guidance and auxiliary services. The Boys' Vocational High School devoted only 2.3% of its budget to the support of personnel providing guidance, library and health services. The regular high schools allocated 8.9% of their budgets to the same three services. The fact that Boys' Vocational had only one man in charge of all guidance and placement is questionable in view of the importance of placing vocational graduates in jobs. The total per pupil expenditure for these three services was $23 at Boys' Vocational and $40 at the regular high schools. The Girls' Vocational had its own method of individual departmental guidance and placement and employed no guidance personnel; and in its effort to keep costs low it also sacrificed the services of a school librarian. It received health services from the same personnel that instructed students in the several health training programs. The cost of these services, as well as the cost of informal guidance by department heads, would be some part of the total salaries paid these instructors. Unfortunately, no figures are available to estimate total time spent by these instructors in the performance of guidance or health duties,

Table 11

Comparative Budgets, Regular High Schools, Boys' Trade, Girls' Trade, 1963-64.

	REGULAR HIGH SCHOOLS	Cost Per Pupil	% of Budget	BOYS' TRADE	Cost Per Pupil	% of Budget	GIRLS' TRADE	Cost Per Pupil	% of Budget
Salaries & Wages									
Teachers	$1,640,940	$285	63%	$473,299	$685	62.7%	$194,950	$570	72%
Super. & Direct.	75,623	13	2.9	29,825	31	3.56	5,941	17.30	2.2
Clerical & Janitors	246,195	42	9.4	70,862	95	9.4	32,703	95.50	12
Guidance, Health, Attendance, Library	231,651	40	8.9	17,421	23.40	2.32			
Tel. & Tel.				$ 3,731	$ 5.00	.49	$ 2,899	$ 8.45	1.7
Books	$ 34,865	6	1.37	548	.73	.07	1,600	4.68	.59
Janitor's Supplies	46,816	8	1.79	2,699	3.62	.036	1,553	4.54	.57
All other Supplies	112,570	19.50	4.3	25,013	33.80	3.3	13,483	39.20	5.0
Water, Elec. Power	32,467	5.10	1.24	22,362	30.00	2.96	6,444	18.80	2.4
Repairs of Land, Build. & Equip.	15,262	2.60	.58	21,412	29.00	2.84	11,287	23.00	4.1
Cafeteria & Athletics	177,154	30.80	6.80	72,436	97	9.6			
Total	$2,608,228	$452	100%	$752,930	$964	100%	$271,443	$793	100%

Source: Office records of Regular High Schools, Boys' Trade, Girls' Trade.

so it is not possible to determine what percentage of their salary should be considered remuneration for guidance or health services rendered.

Two other cost items should be mentioned before discussing the main source of cost differences. First, the size of the vocational expenditure for water and electrical power is much greater than the regular high school expenditure. The Boys' Vocational High School spent $18.80 per pupil. The regular high schools spent the comparatively small sum of $5.10 per pupil. This is due to the particular nature of the trade schools. The large quantities of machine tools necessary to train students also require considerable quantities of electrical power. Second, cafeteria and athletics expenses at the regular high schools were $30.80 per pupil while the Boys' Vocational expenses were $97 per pupil. The regular public schools have their own food warehouses and this cost difference may reflect large economies to scale in the buying and preparing of cafeteria food. Further, there may be large fixed costs associated with the running of competitive athletics.

However, 63% of the absolute difference in public direct current costs is attributable to one budget item. That budget item is teachers' salaries. The Boys' Vocational High School spent $685 per pupil for teachers. Girls' Vocational spent $570 per pupil. But the regular high schools spent only $285 per pupil. The differences in teacher cost may result from the more intensive use of labor in the vocational schools and the somewhat higher wage rate paid vocational teachers.

The more intensive use of labor is reflected in the pupil-teacher ratios evident in the vocational schools. In Table 12, below, the pupil-teacher ratios for the four regular high schools are compared with those of the vocational schools.

Table 12

Pupil-Teacher Ratios for the Regular High Schools
Boys' Trade, Girls' Trade, 1963-64

Classical High	20.6/1		
Commerce High	18.5/1	Worcester Boys' Trade	12.6/1
North High	22/1		
South High	22.5/1	Girls' Trade Trades & Household	12.6/1

Source: Office records of the respective schools.

The average pupil-teacher ratio for the four regular high schools is 20.9/1. This is almost one half that of the vocational high schools. In other words, the vocational schools employ two teachers for every 25 pupils, while the regular high schools use but one and one fifth. This intensive labor use seems to be necessitated by the type of courses being taught. Individual help with shop or projects probably requires extra people, and the presence of expensive machine equipment requires more supervisory functions for those in charge. If ways could be found to better utilize vocational teachers, the schools most expensive resource, total wage costs might be drastically reduced. If the vocational schools had the same pupil-teacher ratio as the regular high schools, 61% of the differences in teacher costs would be eliminated. Since teachers' salaries account for 63% of total cost differences, 38% of total cost differences would be eliminated. The remaining 39% of increased teaching costs is due to the higher salaries paid vocational education teachers. The average salary for vocational teachers in 1963-64 was $7,280 per year. The average salary of the regular high school teacher was $6,000 per year.

The higher salary paid vocational teachers should reflect the fact that his opportunity costs are higher than those of the high school teacher. He is a skilled worker in a field in which labor is supposedly in short supply. He should be able to earn a salary equal to that of the average skilled worker in his trade. A sample of salaries for eight of the eleven trades taught in the vocational school revealed that in 1963-64 the average skilled worker in Worcester earned $5,800 over twelve months. There is no convenient way to estimate the possible transfer wage of the regular high school teacher. It may be that his transfer wage is considerably lower than this $5,800 figure. On the other hand, this $5,800 salary is for a twelve-month period and the vocational teacher earns $7,280 over nine months. It appears, therefore, that the high wage paid vocational teachers is the result of: 1) the current interest in public formal training and retraining courses, 2) the labor intensive methods of instruction used in these courses, 3) the scarcity of people with the vocational teacher's combined talents.

The importance of labor intensive methods of instruction in raising direct costs is best illustrated by considering the Practical Nursing program. As has been stated, its direct costs were considerably lower than the direct costs of all other vocational programs. Investigation reveals that its pupil-teacher ratio was 20/1 rather than the 12.6/1 ratio common to Boys' and Girls' Vocational High Schools. Clearly, as in the case of the regular high schools, the cause of cost differences lies chiefly in the method of instruction which is not as labor intensive as that employed in Boys' and Girls' Vocational High Schools.

Summary

In this chapter all private direct and public direct and implicit costs associated with regular high schools, with the trade schools and with the thirteenth and fourteenth grade technical schools have been computed in order to arrive at the cost of high school vocational education relative to the cost of regular high school education. The cost of Boys' Vocational High School programs ran 2.3 times those of ordinary high school. If only public direct and implicit costs were compared. If private direct costs were added to the comparison, Boys' Vocational High School was still 2.1 times as expensive as regular high school, if public direct and implicit costs were compared. Adding private direct costs to the comparison left the Girls' Vocational High School 1.75 times as expensive as regular high school. All of these costs were expressed in current dollars.

The reasons for cost variations between the programs were explored and it was found that differences in teachers' salaries and pupil-teacher ratios were the main source of cost differences. The cost of WITI programs ran about the same as Boys' Vocational program cost. However, the Practical Nursing program at Girls' Vocational High was much cheaper, a higher pupil-teacher ratio in this program accounting for most of the cost saving.

Chapter IV

THE BENEFIT-COST CONSIDERATIONS

Comparing the Investment in High School Vocational Education with the Investment in Regular High School Education and with WITI

Introduction

The educational budget can be viewed, in one sense, as a monetary constraint imposed from a higher governmental level. Educators in decision-making positions, having received a limited amount of money, must decide how to apportion it optimally among the various types of educational programs. The standard rule to be followed in such a situation is simple: if there is only one constrained financial resource and one category of benefits, then the rate of net benefit per dollar of the constrained funds must be maximized.

The required maximization can be achieved by computing ratios of benefits to costs for each educational project or program. The programs are ranked, priority being given to the one in which net benefits exceed costs by the largest margin. The selection of programs is then made in the order of priority, continuing until the limited budget funds are exhausted. The aim is to maximize total net gain.

When the Worcester vocational school program is compared with the regular high school program, Worcester educators are faced with a maximization problem of the type just described. The size of the total school budget is limited by several variables which include the ability of the city to raise funds through taxation, the desire of the citizenry to support public education and the number of public services which compete for municipal funds.

Given the final school budget and the necessity of maximizing total benefits, educators in Worcester must decide whether to allocate more of their funds to vocational education. This chapter and most of the remainder of the study will be concerned with this decision and its results.

Benefit-Cost Considerations for the Worcester High Schools

The decision-maker is faced with the choice of these two alternative forms of investment in education and must decide which is the more profitable. In order to establish some criterion for choice, the technique of discounting costs and returns can be employed. The decision-maker discounts the streams of returns and the streams of costs for each of the investments. The social rate of discount is assumed to be the market rate of interest and not to change over the course of time. If the discounted stream of returns from the investment in education does not equal the discounted costs, at that market rate, the project would not be worth undertaking.

Proceeding on the assumption that the discounted stream of returns does indeed outweight the costs in both cases under consideration, the decision-maker would pick that project in which the discounted returns outweighed the costs by the larger amount. For example, if at that market rate, the returns to one project were three times the costs, and the returns to a second project were twice the cost, the limited funds at the disposal of the decision-maker would go for support of the first project.

When the problem of choosing between regular and vocational high school is approached, this same technique helps to indicate a choice. For the purpose of arriving at a reasoned conclusion, it can be assumed that four years of regular high school and graduation bring a certain stream of returns in the form of income over and above what is earned by the person who terminates his schooling at the end of eight years. The high school program also involves certain costs. If this stream of additional returns is discounted back and equated with the discounted costs, a given ratio of benefits to costs is obtained. Presumably that ratio is greater than one, and thus, for illustrative purposes, it can be three. Hence, benefits outweigh costs in the ratio of three to one, and high school education is definitely worth undertaking.

If vocational high school education is considered as an alternative to regular high school education certain conditions must be met in order to make this investment equally attractive. It is assumed that graduation following four years of attendance at vocational school results in a stream of returns over and above what is earned by the person who terminates his schooling at the end of eight years, and that this stream of additional returns is identical to the stream accruing to the regular high school graduate. Then, if each year of vocational education costs twice as much per pupil as regular high school education, discounting back the same stream of returns at the same market rate of interest, and comparing it with a discounted stream of costs which differ in each period by a factor of two, results in a benefit-cost ratio lower than that of the regular high school. Thus, if vocational education costs are greater in each period than regular high school costs, the benefit-cost ratio for the regular high school will be higher. The decision-maker would therefore invest in regular high school as long as this situation continued.

However, this would hold only if the benefit streams being discounted were identical. As long as the costs for vocational education remained greater than the costs for regular high school education, the latter would remain the preferred alternative. The costs would have to be identical for the vocational education to appear as an equally attractive investment.

The situation just described is the simplest of the set of possible alternatives the decision-maker would actually face. If the streams of extra returns are no longer assumed to be identical, -- and there is, in fact, good reason to assume that they would not be identical -- the problem becomes much more complex.

The most obvious qualification is that introduced by a consideration of option values.[13] Graduates of the regular high school may have the alternative of continuing their education into college, while vocational school graduates are necessarily involved in what is designed to be terminal occupational training. Some part of the extra returns which accrue to the individual who continues into college and perhaps graduates, as against the individual who seeks employment immediately upon completion of high school must be attributed to the high school education of the former. This extra return to high school education would be the return for serving as a necessary condition for college entrance.

Further, the vocational school graduate who enters the labor market after graduation may receive a greater stream of benefits than the individual who graduates from regular high school but does not go on to college. While some part of these extra benefits would have to be attributed to vocational education for serving as a necessary condition for entrance into more lucrative jobs, the remainder would have to be attributed to the training he has already received.

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[13] For a discussion of the notion of educational options, see B. Weisbrod, External Benefits.

Thus it appears that the benefit streams from the two types of education will differ. It is already known that the costs differ. The question to be answered remains basically the same: Under what new set of conditions will the vocational education appear as attractive an investment as that of regular high school?

The decision-maker can consider the vocational investment relative to the entire regular high school investment or relative to the terminal regular high school investment. It is assumed that rather than comparing the vocational school investment with the entire regular high school investment, the decision-maker compares it only with that of the high school which is terminal. This assumption eliminates the need for attempting to determine what part of the extra returns resulting from college education should be imputed to the regular high school stream of benefits as additional. Instead, the decision-maker has to choose between a vocational education program and a regular high school program, the graduates from both of which will enter the labor market.

Given that vocational education is more expensive and that investment in regular high school is profitable, then the choice between the two investments will be a matter of indifference if and only if, the vocational education generates an income stream which lies above that which the regular high school generates, and the present value of the differences in these two streams is just equal to the present value of the differences in the costs of the two programs.

Thus, explicitly, if at a given social rate of discount the investment in regular high school education has a benefit-cost ratio of 3 to 1 and the above condition is satisfied, the vocational investment will also have a benefit-cost ratio of 3 to 1. If the present value of the differences in these streams is greater than the present value of the differences in the costs, the vocational investment is more profitable than the regular high school investment. If the present value of the differences in benefits is less than the present value of the differences in costs, the vocational education is less profitable.

Considering only public direct and implicit costs and private direct costs, educating pupils at the Boys' Vocational School costs 2.13 times as much as the regular high school. The same calculation applied to the Girls' Vocational School shows it to be 1.75 times as much. The absolute difference in these costs is $678 per pupil per year in the case of the Boys' Vocational School and $445 per pupil per year in the case of the Girls' Vocational School. If it is assumed that these cost differentials are maintained over the four required years at the respective schools, then during that period $2712 extra would be spent in educating pupils at Boys' Vocational School and $1780 extra would be spent educating pupils at Girls' Vocational. In a comparison of these cost differentials with the differences in benefits, the absolute magnitudes would have to be discounted.

Two questions remain. First, should foregone earnings be included in the calculation of costs? Second, given the appropriate discounted cost differences, are the earnings of vocational graduates such that the two types of high school education are equally profitable?

There are really two possible answers to the first question. We could argue that since schooling is compulsory, actual foregone earnings for high schoolers are zero and should not be considered. Alternatively, we could argue that since foregone earnings for students at any of the high schools are approximately equal, we are justified in factoring these costs out. Again, we would then concern ourselves only with public direct and implicit costs, and private direct costs.

The other possible answer is to say that foregone earnings are an integral part of the total resource costs of education. As such, they cannot be eliminated from cost-benefit considerations.

In either case, as long as foregone earnings for the respective groups of students are the same, the absolute difference in costs remains unchanged. However, if foregone earnings for male and female regular high school students are greater than foregone earnings for the two counterpart groups of vocational school students, inclusion of them would reduce the absolute difference in costs. If foregone earnings for the vocational students were higher than the corresponding foregone earnings of regular high school students, inclusion of them would increase the absolute difference in costs. In this study foregone earnings are taken to be the same for the respective groups.

The second question can only be answered by a careful analysis of the earnings of vocational and regular high school graduates. This study uses two separate pieces of information in an attempt to gain a partial answer.

Benefit-Cost considerations for Boys' Vocational High School

One part of the answer is revealed by looking at the differential in starting wages that exists between those graduates of Worcester Boys' Vocational High School hired locally and the graduates of the regular high school hired at the same firms.

The differentials in starting wages are taken from a sample of twelve firms in the Worcester labor market. All twelve firms were engaged in manufacturing and were primarily interested in hiring workers as machine operators. The firms had all hired graduates from the vocational school during the June 1964 -- June 1965 period. The firms also hired, as machine operators, regular high school graduates, some of whom had just completed their schooling. Some had already graduated from high school and were in the labor market at the time of their hire. Obviously, this latter group was composed of the previously unemployed and those moving from other firms. Total employment in this group of twelve firms, in 1964, was 9500 or 23% of the total of 41,000 employed in manufacturing within the Worcester Standard Metropolitan Statistical Area. In Table 13, below, the starting wage paid vocational school graduates is compared with the starting wage paid regular high school graduates.

In the two largest firms, vocational school graduates and regular high school graduates received almost identical starting wages. The vocational school graduate received a 4¢ per hour premium, about 2% more than the regular high school graduate. In the smaller firms, the vocational graduate received a slightly higher premium for his advanced training. However, 28¢ per hour was the largest premium paid.

The 4¢ per hour differential would result in a $1.60 per week premium for a forty-hour week or $82 per year for a fifty-week year. The same sort of calculation reveals that the 13¢ per hour differential would amount to a premium of $260 per year. The 18¢ per hour differential would result in a yearly premium of $360, while the 28¢ per hour differential would result in a premium of $560 per year. Finally, the 25¢ per hour differential would produce a premium of $500 per year.

It is clear from this set of data that differentials on both the cost and benefit sides exist. Given these differentials, if some assumptions

Table 13

Starting Wages Paid Graduates of Boys' Trade School and of Regular High School Who were Hired as Machine Operators in Worcester June 1964 to June 1965.

Total Number of Employees in Firm Employing Trainees	Number of Firms Sampled	Average Starting Wage		Average Differential in Starting Wage
		High School Grad.	Trade School Grad.	
More than 1000	2	$1.95 per hour	$1.99 per hour	4¢ per hour
More than 500 less than 1000	3	$1.76 per hour	$1.89 per hour	13¢ per hour
More than 200 less than 500	2	$1.64 per hour	$1.82 per hour	18¢ per hour
More than 100 less than 200	3	$1.70 per hour	$1.98 per hour	28¢ per hour
More than 25 less than 100	2	$1.70 per hour	$1.95 per hour	25¢ per hour

Source: Independent field survey conducted by research staff.

about the shape of the two competing benefit streams are made, it is possible to deduce a set of implications which should aid the decision-making process.

First, it is assumed that the starting wage differential remains constant and then an attempt is made to find how many years it would take before the discounted stream of differential benefits is equal to the discounted stream of differential costs. In performing this calculation the social rate of discount can be varied in order to take account of the diversity of opinion which exists on the question of which discount rate is correct. Since the starting differentials vary among the firms, given a rate of discount, the length of time necessary to equate present values will vary between firms. The rate of discount is always the same rate which would have to be used in the calculation of the over-all respective profitability of regular high school or of vocational high school.

With the necessary calculations, it is found that at a 5% rate of discount, and $80 per year differential maintained over the entire working life, would not be sufficient to equate the present value of these extra returns with the present value of the extra cost of vocational education. The $260 differential would equate the present value of extra costs and returns in approximately 17 years, while the $360 differential would equate these present values in 11 years. With the differential of $560, the present values could be equated in just over 6 years, and the $500 differential would bring about this result in 7 years.

At a 10% rate of discount, neither the $80 per year differential nor the $260 per year differential would be sufficient to equate the present values. The $360 differential could result in equating of the present value of extra costs and returns after 30 years. The $560 differential now would take

10 years to equate the present values instead of just over 6, while the $500 differential would take 12 years instead of 7.

Table 14

Number of Years Wage Differentials would have to Remain, In order for the Present Value of Extra Costs to be Equal to Present Value of Extra Returns.

Wage Differential	5% Rate of Discount	10% Rate of Discount
80	Never Equated	Never Equated
260	17	Never Equated
360	11	30
560	6 1/6	10
500	7	12

Source: Independent Field Survey.

Hence, at a 5% rate of discount, all starting wage differentials except the $80 differential are large enough to make vocational education an investment at least equally as attractive an investment as high school education. However, this conclusion holds only if the decision-maker's horizon is the entire working life of the graduate. If the decision maker has a limited horizong, that is to say, requires that the present value of extra returns be equal to the present value of extra costs within a specified time period, the conclusions no longer hold.

If the decision-maker requires that the present values be equated within 5 years from the time of graduation, clearly, none of the differentials presented here would be sufficient. A ten-year horizon would allow the decision-maker to invest in vocational education in some cases, while a fifteen-year horizon would allow investment in a wider set of circumstances. That is, with a 5% rate of discount, a 10-year horizon would allow the decision-maker to choose vocational education in those cases where the differential was $500 or $560 per year. A fifteen-year horizon would allow the decision-maker to include a $360 differential. With a 10% rate of discount, the $500 and $560 differential is still sufficient, provided a 15-year horizon is used. There is, in fact, good reason to employ a limited horizon and to question whether the starting wage differential will remain constant.

Since vocational education is, in part, a substitute for on-the-job training, the extra return the vocational graduate receives relative to that of the regular high school graduate employed in the same trade, is, in part, the return to that training. Under perfectly competitive conditions in the labor market,[14] the difference in starting wages would indeed represent the return to investment in training. The untrained high school graduate entering the trade would have to bear the entire cost of training in the form of lower wages; hence the vocational graduate would be receiving a differential which represented that training advantage. Unfortunately, perfectly competitive labor markets are not usual and each firm can compete for trainees by offering different cost-sharing arrangements to newly-hired trainees. The extra return given the vocational graduate is probably closer to a premium paid for his diploma than a premium paid for his training alone. For example, the firm may assume the vocational graduate is less mobile than the regular high school graduate even though it bears part of the cost of training the regular high school graduate and perhaps reduces the actual differential for training already received, the firm might choose to add to the vocational graduate's starting salary because there was less chance of his easily migrating.

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[14] G. Becker, op. cit.

Whatever the starting differential between the vocational graduate and the untrained high school graduate in the same trade, it is reasonable to assume it would decrease with time. As the regular high school graduate was trained on the job, his earnings would increase until at some future time the difference in the level of skill between the two men would have ceased to exist. From that time differences in earnings between the men would have to be attributed to a set of variables entirely divorced from the training process.

If the starting differentials decreased with time so that at the end of five years the differential no longer existed, the decision-maker would then treat vocational education as an investment equally as attractive as regular high school education if, and only if, at the end of that specified period the present value of the extra returns were again equal to the present value of extra costs.

It is possible to assume that the two wage rates will converge in a carefully specified manner, but such assumptions are merely illustrative of the problem. For example, it can be assumed that the vocational graduate enjoys an initial wage advantage over the regular high school graduate in the same trade, which decreases over five years along a path which can be traced by simply depreciating that initial differential, using the straight-line technique: It can then be shown[15] that at either a 5% or a 10% rate of discount, none of the starting differentials observed in this study would suffice to equate present values of costs and benefits. Even when the length of the depreciation period is extended to ten years, the starting differentials are still not sufficient to equate present values.

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[15] See Appendix I

All of this implies that if the vocational investment is going to be a more attractive one than the investment in high school education, the wage differential should either be higher initially or perhaps increase with time. The possibility of these wage differentials widening over the course of the years should depend on the internal wage structure and upgrading policies of the firm. The policies will be discussed more thoroughly in the next chapter.

It must be pointed out that this study of starting salaries can, at best, only begin to investigate the value of the investment in vocational education. It is, after all, only the first year of a lifetime of work which could last 47 years. This would be the maximum working life of anyone who graduated at 18 years of age, and worked until the normal retirement age of 65 without suffering any periods of unemployment or temporary removal from the labor force. Further, it must be pointed out that these starting salaries of the vocational graduate are compared only with those of regular high school graduates who have been hired in a particular part of the manufacturing sector. Certainly the vocational graduates should be followed over longer periods of their work-life and their earnings should be compared with those of all high school graduates. Moreover, the number and kinds of occupations studied should be increased. If non-college bound regular high school graduates experience much higher unemployment rates as a group than do vocational school students, all extra costs incurred at the vocational school could be recovered in a short period. This empirical discussion evaluates vocational education as an alternative to regular high school plus on-the-job training. It does not consider its relative effectiveness in preventing unemployment.

However decision-makers should also be concerned with the opportunity costs to the community which are associated with an investment in high school vocational education. In the case of Worcester a decision to discontinue vocational education for Boys could release $300,000 which could be spent on the enrichment of the entire high school system.

Moreover, in 1964 the per pupil current costs at the regular high school were $452. The current costs at the Boys' Vocational School in that same year were $964 per pupil, resulting in a difference of $512 per pupil. Thus public authorities could give a local firm up to $512 per year to train a regular high school graduate and still spend only as much as is spent on a vocational school student in one year. This type of on-the-job training might result in greater returns to training than can be gained through vocational school training. The sample of starting salaries does show that the actual training received by the vocational graduates brings very little immediate salary return. In the largest firms all of the shop hours spent by vocational students interested in machine operator training brought only a 4¢ per hour wage premium. Whatever the long-term advantages of hours spent in school shop training, they do not seem to be reflected in immediate worker productivity gains.

Benefit-Cost Considerations for Girls' Vocational High School

The work histories of the graduates of Girls' Vocational High School reveal the second piece of information which relates to the success of vocational students in the labor market. The Girls' Vocational School, over the years, has made a serious attempt to keep track of their graduates. Each department head in the school serves a guidance function. Follow-up cards are regularly brought up to date by the department head, who sends information cards to be filled out and follows up with phone calls. Graduates are asked to report salary, job changes and any movement out of the occupation area in which they were trained. Data is collected at the time of graduation, six months later, and once a year thereafter. Hence, in the first eighteen months after graduation, the graduate is asked to fill out information sheets on three different occasions. The information presented here concerns only the Trade and Home Making graduates. No discussion of the Practical Nursing program is presented. There are eighteen-month work histories for the class of 1962 and 1963 and a six-month report for the class of 1964.

In June 1962, 39 girls graduated from the Cosmetology or Hairdressing program. All but three of the girls were placed in jobs. The starting salary for 32 of the 36 placed on jobs was $1 per hour or $40 per week. The other four graduates received a slightly higher starting salary, averaging $1.23 per hour, or $49 per week.

Six months later, of the 39 graduates, eight reported that they were no longer full-time employees, fifteen others were working at the same job and receiving the same salary as at the time of their initial hire, and eight others had received salary increases which averaged 20¢ per hour, or $8 per week. Five girls did not reply to phone calls or postcards and thus could not be located for information.

At the end of eighteen months, five of the eight graduates who had dropped out of the labor force to marry had returned and were working wives. Of the fifteen who had not received a salary increase in the first six months, eleven had still not received such an increase and four had received a salary increase which averaged 26¢ per hour. Three of the group who had received salary increases in the first six months after graduation, received an additional increase which averaged 7¢ per hour. Two members of this group of eight had dropped out of the work force.

In all, from an original group of 39 graduates 20, or 51 percent, were employed full time in the cosmetology field eighteen months after graduation. Seven members of this group still received a base pay of $1 per hour. The other thirteen earned an average base pay of $1.25 per hour. The average base pay for the group as a whole was $48 per week, or $1.13 per hour.

In the Dressmaking Program the school graduated nine girls in June of 1962. Seven of the nine were placed at jobs related to the training they had received. The average starting salary for this group was $1.15 per hour.

Six months later, one girl had left work and married; another had married and continued working. The other five girls had continued working full time. Two raises were granted and the average salary for the group was now $1.21 per hour. At the end of eighteen months five girls were still working in the trade. The average hourly wage for this group of five had risen to $1.33 per hour. The other two girls who had originally been placed were now married and at home.

In June of 1962, six girls graduated from the Food Trades training program. Four of the girls were placed at an average hour wage of $1.30. Six months later all four girls were still working and their wage rate was identical to what it had been at the outset. Eighteen months later the four girls were still working. One girl had received a wage increase, bringing the average wage for the group to $1.32 per hour.

Graduates from the Homemaking program were trained for work in a variety of service jobs. Of the seven 1962 graduates, only two took jobs. Two of the other five took further training, and three did not seek work. The two who did take jobs received a starting wage of $1.10 per hour.

Six months later four of this group of seven were married and at home. The three working members of the group earned an average wage of $1.32 per hour. The end of eighteen months brought no changes in the composition or earnings of this small group.

Twenty-nine of the 42 cosmetology students who graduated in 1963 were placed in full-time jobs. One graduate took training in practical nursing and one was employed part time. Twenty-one of the graduates received $1 per hour starting wage and the average starting wage was $1.02 per hour.

Six months later, four graduates had left the labor force. Three of the four became housewives and the fourth returned to school. Two others had become part-time employees and one had taken a job outside the cosmetology field.

Table 15

Placement Record for Girls' Trade School Graduates

Class - June 1962

	Number Graduated	Employed in Trade		Average Salary
		No.	%	
Cosmetology	39	36	92	$1.13 per hour
After Six Months	--	23	59	1.09
After 18 Months	--	20	51	1.13
Dressmaking	9	7	77	1.15
After Six Months	--	6	66	1.21
After 18 Months	--	5	55	1.33
Food Trades	6	4	66	1.30
After Six Months	--	4	66	1.30
After 18 Months	--	4	66	1.32
Homemaking	7	2	28	1.10
After Six Months	--	3	43	1.32
After 18 Months	--	3	43	1.32
TOTAL	61	49	81	1.17
After Six Months		36	59	1.23
After 18 Months		32	52	1.27

Source: School records, David Hall Fanning School for Girls.

Nine of the twenty-one graduates who had started work at $1 per hour were still earning the same basic hourly wage. Seven members of this group received raises which averaged 25¢ per hour. There was no record of two graduates in this group and the other three were either part-time employees or not working in the field.

Eight graduates had started work at salaries which averaged $1.18 per hour. Five members of this group received additional wage increases during the six months. In all cases the increase brought the hourly wage to $1.25 but no higher. The one individual who had begun work at $1.50 per hour had left to marry.

At the end of eighteen months only six people were still earning $1 per hour base pay. Raises had been granted to six girls. Those already earning $1.25 per hour received an average increase of 15¢ per hour. Those who had been earning $1.00 per hour received 25¢ per hour increases. The total number of people still in the trade diminished by one, as a part-time worker dropped completely out of the labor market. One housewife did return to work but not in the cosmetology field. Finally, two girls did not return their questionnaires.

Hence, at the end of 18 months it appears that eighteen girls were still working in the cosmetology field. Their average base pay was approximately $1.18 per hour, or $47 per week. Of the 29 graduates who took full-time jobs in cosmetology in June of 1963, 18, or 62 percent, were still full-time workers in the field eighteen months later.

In June of 1963, only six girls were graduated from the dressmaking training program. Five of these six girls were placed, and the average hourly wage for the group was $1.25. Six months later all five girls were still working in the trade, although one had changed jobs. The average hourly wage at this time was $1.41. At the end of eighteen months only four girls remained in the work force. The fifth girl had left the work force and married. The average hourly wage for this small group was now $1.30. This drop is explained by the fact that the one girl leaving the work force was earning a far higher salary than the rest of the group.

There were sixteen graduates from the Food Trades program. Fifteen of these girls were placed in jobs in their field of training at an average hourly wage of $1.30. Five members of this group received $1 per hour as a starting wage.

Six months later, five people were no longer working in the food trades. Four of these five were completely out of the labor market. One person had returned to school. The other three had been earning $1 per hour and had left work to become housewives. Those still in the food trades were now earning an average hourly wage of $1.46.

At the end of eighteen months two more people had left food trade jobs to take employment in areas unrelated to their training. One person who had stopped working returned to the trade area. There were nine people still working in the food trades eighteen months after graduation. The average hourly wage was still $1.46.

An even smaller group of homemakers graduated in June of 1963. Two members of a group of four graduates found work. The other two took further training. The two people working earned $1.15 per hour. Six months later three of the four graduates were married and were not working. Eighteen months after graduation all four girls were married and out of the labor force. A summary of the finding for the class of 1963 can be found in Table 15.

Thirty-five of the 38 graduates in the June, 1964 class were placed in cosmetology positions. Three other graduates were married upon graduation and did not seek work. Twenty-seven of the 35 received a starting salary of $1 per hour. The remainder of the group averaged $1.23 per hour. In all, the average starting wage for the group was $1.02 per hour.

Six months later, nine individuals were still earning $1 per hour base pay and were employed at the same firms. Two other individuals changed jobs but did not increase their base pay above the $1 per hour level. There were thirteen others whose base pay increased to the $1.25 per hour level. Eight of those who had received increases had changed jobs. Of the remaining three individuals who had started at $1 per hour, one left the field to take an office job, one left the labor market and married, and one could not be located.

Six of the eight individuals who had received starting salaries above the $1 per hour level, did not receive a wage increase during the first six months of employment. Two individuals did experience changes in their base pay: one person received a 7¢ per hour increase and one changed jobs but took a cut in base pay.

In all, out of a graduating class of 38, there were 32 still working in the field six months after graduation. Only two of the 35 graduates originally placed on jobs had left the cosmetology field. One of the two was still working although not in cosmetology. The average base pay for the group of 32 working in the field was $1.15 per hour.

In June of 1964, a far larger group of girls completed training in the dressmaking field. Twenty girls were graduated. Fourteen of the girls were placed in industry at a starting wage of $1.25 per hour. One girl continued schooling. Two girls took employment in an unrelated area and three girls remained at home.

Table 16

Placement Record for Girls' Trade School Graduates

Class - June 1963

	Number Graduated	Employed in Trade		Average Salary
		No.	%	
Cosmetology	42	29	69	$1.02 per hour
After Six Months	--	21	50	1.14
After 18 Months	--	18	44	1.18
Dressmaking	6	5	83	1.24
After Six Months	--	5	83	1.41
After 18 Months	--	4	66	1.30
Food Trades	16	15	93	1.30
After Six Months	--	11	69	1.46
After 18 Months	--	9	56	1.46
Homemaking	4	2	50	1.15
After Six Months	--	1	25	1.15
After 18 Months	--	0	0	----
TOTAL	68	51	75	1.18
After Six Months		38	56	1.29
After 18 Months		31	46	1.31

Source: School records, David Hall Fanning School for Girls

Six months later, nine of the 14 girls were still earning $1.25 per hour. Three girls had received raises which averaged 10¢ per hour. One girl left the trade to become a housewife and one girl failed to respond to inquiries. There was no change in the status of the other six girls. Thus, all together, 12 of the 20 girls graduated in July, 1964 were still working in the trade six months later. The average wage for this group was $1.26 per hour.

The school placed 12 of its 13 Food Trade graduates of 1964. The average hourly wage for this group was $1.43. After six months four of the twelve had left the food trade area and two of this group of four had dropped out of the labor market. The average hourly wage for those still in the trade was $1.63.

In June of 1964, 12 girls graduated from the home-making program and six took jobs. The six who did take jobs earned an average hourly wage of $1.25. Six months later, the only change that had occurred was the marriage of one of the group of six workers, reducing the number of those employed to five.

These three vocational class histories raise several questions about the value of traditional vocational education for girls. The over-all placement rates for each of these classes was good. In 1962, 81% of those graduating were placed in jobs related to their training. The percentages for 1963 and 1964 were 75% and 81% respectively. At the end of eighteen months both the 1962 and 1963 classes had suffered from serious attribution rates. Only 52% of those graduated in 1962 were still working in their trade areas eighteen months later. Only 46% of the original graduates of the 1963 class were still working in their trades eighteen months later. The class of 1964 had 69% of its original graduates still working six months after graduation.

Table 17

Placement Record for Girls' Trade School Graduates
Class - June 1964

	Number Graduated	Employed in Trade		Average Salary
		No.	%	
Cosmetology	38	35	92	$1.02 per hour
After six months		32	84	1.15
Dressmaking	20	14	70	1.25
After six months		12	60	1.26
Food Trades	13	12	92	1.43
After six months		8	61	1.63
Homemaking	12	6	50	1.25
After six months		5	41	1.25
Total	83	67	81	1.24
After six months		57	69	1.34

Source: School Records -- David Hall Fanning School for Girls.

More important, in the light of the number of hours spent in training at the school, it is particularly discouraging to find that the wages these girls earned were close to the federal minimum wage. In 1962 the over-all average starting salary was $1.17 per hour. This salary was 8 cents per hour below the federal minimum wage. Six months later the average had moved to $1.23 per hour, still 2 cents per hour below the minimum wage. Only after eighteen months did those still working earn more than $1.25 per hour minimum; their average salary was $1.27 per hour. The class of 1963 did not fare much better; their average starting salary was $1.18 per hour. This was almost identical to the average starting salary for the 1962 class. However, they had advanced to $1.29 per hour within six months and to $1.31 per hour at the end of eighteen months. By 1964 the vocational graduates started work at about the minimum wage. They earned an average wage of $1.24 per hour, just below the $1.25 per hour minimum. In six months they had moved to $1.34 per hour.

The higher salaries earned after six and eighteen months were earned by those still in the trades. If those earning lower salaries dropped out of the area of work for which they had trained, these dropouts would cause the average salary for the remaining workers to rise. Hence, the salary progress experienced by the group would be accompanied by the steady attrition of vocational graduates for the labor force.

On the other hand, the salary figures do under-state the actual wages of the girls in one important way. Cosmetology graduates receive tips, and a commission on new business and these tips and commissions in some cases can raise weekly salaries considerably. The small amount of information available indicates that the extra income can average 60 cents per hour.

The low hourly wages earned by these students could hardly indicate that their incomes would be substantially greater than graduates of regular high school programs. However, the four training programs studied here are in what might be termed traditional areas of vocational training. It is very possible that some of the newer training programs in the medical and dental or data processing areas might bring high salaries to graduates. Just how much these graduates would earn is again an empirical question.

Benefit-Cost Considerations for WITI

The vocational training carried on at WITI presents a different problem. Educators must decide whether investing a dollar in WITI programs brings greater net benefits than investing it in Junior College programs. For this evaluation they would require the same sort of comparison of lifetime income streams and costs described in the evaluation of vocational and regular high school programs.

However, since public school educators do not administer Junior Colleges, they do not even have the option of investing in such programs. Junior Colleges, if publicly owned, are state controlled public investments. The state must decide how to allocate its higher education budget for Junior College, four-year State College and State University programs. Therefore, Junior Colleges compete for funds within the higher education budget.

Public school administrators in Worcester have the option of investing in regular high school, vocational high school or WITI. Assuming they will invest in some vocational training, the relevant question is whether they should invest in high school or post-high school training.

When the choice is between vocational education at the post-high school level and the same education at the high school level, some interesting questions arise. Vocational education should be considered a partial substitute for on-the-job training. The question is whether to invest in that training during the first twelve years of schooling or to add two years to the public education system which would be a move counter to that indicated by those who have argued that the number of school years ought to be decreased from twelve to ten.[14] For example, the "Machlup plan" would compress into ten years all the material now taught in twelve years. On the other hand, the plan to provide post-high school vocational-technical education would extend what could be taught in twelve years into a fourteen-year program.

Graduates of the post-high school program would have to earn more than graduates of the high school vocational program if the investment in post-high school training is to appear rational. If high school vocational graduates earned as much as post-high school graduates, then the marginal return to the extra investment in education would be zero. The individual would forego two years of earnings and incur direct costs but would receive no increase in lifetime income for his investment.

The individual could receive a non-pecuniary benefit from the knowledge that he had completed some sort of program of higher education. If graduating from post-high school vocational education programs resulted in a higher probability of going on to earn a four-year degree than would graduation from vocational high school, the option to obtain this four-year degree might be an indirect pecuniary benefit that would make the investment somewhat more attractive.

The requirement that post-high school vocational training result in higher earnings stands only if the two competing programs are identical; that is, if certain kinds of vocational education require an educational background equivalent to that of regular high school, then obviously high school vocational training and post-high school vocational training are not alternatives. If the vocational program is offered at the post-high school level as is offered at the high school level, then the extra return to the investment in extra education would be only the result of the added number of school years completed. The decision to forego earnings for two years beyond high school without gaining added income would be irrational. On the other hand, the added income would not be due to the training received, since the individual could have gotten the same training at the high school level. Hence, the added income would simply be a premium paid by entrepreneurs to those individuals who seemed to demonstrate some extra ability in graduation from high school and following this with extra training. From the foregoing, then, it could be held that post-high school vocational training either does not increase lifetime earning, and individuals would be irrational to invest in it, or it does increase lifetime earning because entrepreneurs pay a higher wage simply for the number of school years completed and not for the training received in additional years spent in school.

In Chapter I we saw that the Boys' Vocational High School program offers the student his choice of eleven different training courses in the skilled trades. The WITI school program offers the student the same eleven training courses and four additional courses which are really technical training programs, as opposed to the eleven skilled training programs.

In September 1960, 176 boys entered the ninth grade of Worcester Boys' Vocational High School. Of the group that entered, 123 eventually graduated, although not all graduated within four years from the time of entrance. Out of the group of 123 there were 101 who were placed in occupations directly related to their training. In June of 1964, seventy-six of this group of 101 graduated and were placed in jobs.

In September of 1962, 121 students enrolled in WITI, the post-high school vocational program. Of the group that entered, 90 graduated two years later. Forty-two of these graduates had taken the same training courses as had the high school vocational graduates. The other 48 graduates had taken one of four technical training courses open only to post-high school students. Of the 42 who had taken the same training courses as the high school students, 34 were placed in occupations directly related to their training. Of the 48 who had taken training courses open only to post-high school students, 37 were placed in occupations directly related to their training. The evaluation begins with a comparison of the placement records of the 34 graduates who took the same training courses as the high school students, with the placement record of the 76 vocational high school graduates.

The starting salaries of those post-high school graduates reveal that in two of the eleven trade areas, the post-high school graduates received less than the vocational high school graduate. In three other trade areas the post-high school graduates received the same starting salary as the vocational high school graduate. In the other six trade areas, the post-high school graduate received a higher starting salary. The amount of the premium paid post-high school graduates varied from 5 cents per hour to 35 cents per hour. The average amount of the premium was 20 cents per hour. If a straight time forty-hour week is considered, this amounts to $8 a week, or $400 a year for a 50-week work year. The annual figure assumes that the wage differential remains the same, in absolute terms, for the course of the working year.

Each of the six trade areas are taken separately and it is found that two paid a premium of 5 cents per hour. This is $2 per week, or $100 per year. Three other trades paid 25 cents per hour. Performing the same calculation results in totals of $10 per week or $500 per year. Finally, in one trade area the premium paid was 35 cents per hour. This 35 cents per hour premium would amount to $14 per week, or $700 per year.

The average starting wage for an individual from this group of WITI graduates, who took one of the eleven trade courses offered vocational high school students, was $1.84 per hour. The average starting wage for the vocational high school graduate was $1.76 per hour. Hence, in all, the average premium paid post-high school graduates was a mere 8 cents per hour, or $3.20 per week, or $160 annually.

The picture is somewhat improved by the facts revealed about that group of 37 WITI students who took training open only to high school graduates and were then placed in jobs related to their training. For this group of 37, the average starting wage was $1.95 per hour. This, of course, is 19 cents per hour above the vocational high school graduates starting wage, and 11 cents per hour above the wage paid post-high school graduates of the eleven trade courses. The individual who graduated from one of these four programs began his career by making about $8 per week, or $400 a year more than if he had taken a trade course at the high school level.

The Costs

The cost calculations in Chapter II revealed that the public costs for WITI training are almost identical with the public costs for the Worcester Boys' Vocational High School. Because both private direct costs and foregone earnings are higher for WITI students, the total resource cost per pupil at WITI is somewhat higher than at Boys' Vocational High.

When public costs were examined in Chapter II, it was seen that Boys' Vocational High School education in Worcester is about 2.3 times as expensive as regular high school education. For the purpose of simplification the public costs of vocational high school education can be said to be twice those of regular high school education. Hence, from a public cost point of view, there is no difference between buying two extra years of vocational technical education and buying four years of vocational high school education.

Assuming, then, that all those now taking vocational high school education were to be put in post-high school programs, before they could enter they would still have to graduate from regular high school, and since regular high school costs are one half those of the vocational school, the four-year savings gained by keeping these people at the regular school would buy two years of post-high vocational technical training. Of course, if expanding post-high school enrollments caused marginal costs to rise, this might not be the case. Hence, for the conclusion to hold, it must be assumed that marginal costs are equal to average costs.

If private costs are considered, the picture is somewhat altered. The individual who foregoes two years of employment incurs real costs in the form of lost earnings. When direct school costs are added to these foregone earnings, a total yearly per pupil cost of $2544 is estimated. Thus the total resource cost of adding two years of vocational training beyond the high school level are $3818 per pupil per year. This compares with total resource costs of $2388 per pupil for the vocational high school and $1708 per pupil for the regular high school.

An Evaluation

The individual who completed two years of post-high school training seems to have made a poor investment if he chose one of the eleven training programs open to vocational high school students. He has foregone two years of earnings and incurred direct school costs. These items have totalled $2544 per year. In return, he received in the first year, an

Table 18

Total Resource Costs

Worcester Public High Schools,
Worcester Boys' Trade School
Worcester 13th and 14th Grade Vocational-Technical School (WITI)
1963-64

		Public High Schools $ per pupil	Boys' Trade School $ per pupil	Post-High School Vocational-Technical (WITI) $ per pupil
I.	Total Public Cost	532	1210	1274
	a) Current Cost	452	964	1028
	b) Implicit Rent[g]	59	165	165
	c) Property Tax Loss	21	81	81
II.	Total Private Costs	1176	1176	2544
	a) School Related Costs[h]	56	56	121
	b) Foregone Earnings	1120	1120	2423
III.	Total Resource Costs	1708	2386	3818

Sources:

1) Worcester Public Schools, Office of the Superintendent.

2) Worcester Boys' Trade School and Worcester Industrial Technical Institute (WITI).

3) Office of the Assessor - City of Worcester.

4) Massachusetts State Department of Education, Department of School Building Assistance.

[g] Implicit Rent and Property Tax losses estimated, using techniques in T. Schultz, "Capital Formation by Education," Journal of Political Economy, Vol. LXVIII (1960), p. 575 and F. Machlup, op.cit. p. 100.

[h] Private Costs estimated, using techniques in T. Schultz, "Capital Formation by Education," op.cit. p. 575.

average salary $160 greater than the vocational school graduate. Unless he could look forward to a much more lucrative career than his vocational school counterpart, it certainly appears that he should have chosen to train at an earlier age.

The graduate of the post-high school program who enrolled in training courses open only to high school graduates found himself in a somewhat different position. Again, his two year costs were considerably higher than the immediate premium he received, relative to the vocational school graduate. In fact, his costs were $2544 per year and his salary average $400 per year higher than that of the vocational school graduate. However, his job was in the category of technician rather than that of skilled worker. In no way could it be argued that he would earn the same approximate lifetime income as the vocational school graduate.

The slightly higher starting salary paid graduates of the post-high school course who trained in the same areas as vocational students, appears to be a premium for having graduated from high school. It could be argued that whatever chance the post-high graduate has of earning more than his vocational school counterpart in the same skilled trade, is due to his higher ability, indicated by his completion of regular high school. Similarly, the potentially more lucrative careers in the technical areas began with training which required high school graduation as proof of ability.

One need not draw the conclusion that training really ought to occur at the post-high school level. Since private costs are much greater than the immediate wage premium paid post-high school graduates, there is an obvious pay-back period involved -- some definite length of time during which all of the relatively higher wages paid these graduates, must be charged off against the initial deficit. This means that the initial premium must be maintained and enlarged for some time, or the extra costs will never be recovered. In the present instance it was assumed that the average premium paid post-high school graduates relative to vocational school graduates in the same trades amounted to $160 per year, the assumption being that the absolute difference in starting wages was maintained for the entire year. The difference between this figure and the private cost figure of $2544 is $2384. Unless the absolute difference in wages received by the two groups of graduates widened, it would take 15 years to pay back the costs incurred during one year of post-high school training. Given the highly uncertain nature of an individual's labor market experience, it appears that an effective measure might be to minimize the pay-back period.

This measure could be accomplished by offering an accelerated training program during the last two years of high school. Those vocational students not able to proceed at the faster pace would take the ordinary four year program. Those students who would ordinarily graduate from high school and then take vocational training could undertake a two-year program, beginning at the eleventh grade. Completion of training would also mean completion of high school. No added private costs would be incurred by these students. If the present higher starting salary of these students is due to their higher ability, entrepreneurs could still distinguish between those who took a four-year training program and those who took a two-year program.

Much the same sort of argument can be made for those who took technical training. If high school education is actually a necessary condition for this type of training, not much can be done. On the other hand, the average premium paid these graduates in the first year, relative to that paid vocational high school students, was $400. This would mean a pay-back period of 5.3 years for one year of training beyond the high school level.[15] Obviously, if their training could be given at the high school level it would be expedient to do so. Finally, it was said that providing post-high school training could be a worthwhile undertaking if the individual bettered his chances of going on to four year college. To re-examine the actual numbers of Worcester Vocational High School graduates and post-high school graduates who continued their education, out of an entering vocational high school class of 176, only six continued their schooling beyond high school; out of an entering post-high school class of 121, only 3 continued their schooling beyond the two-year training program. The vocational school sent 3.4% of its graduates on to higher education and the post-high school program sent 2.5%. At least in this particular case, both programs seem to be terminal occupational training.

Several factors may modify the findings presented in this section. Again, only starting wages are discussed. Certainly investigators should follow vocational and technical school graduates over several years of their working life. In addition, direct benefits in the form of lifetime income are really only the most immediate return to educational investment. There may be several categories of external benefits which accrue to one or another of the training groups studied. The distribution and magnitude of these external benefits may considerably alter the tentative conclusion reached here.

In the next chapter of this study some of the benefits of vocational education not clearly measured by income differentials will be considered. These findings may somewhat modify the conclusions reached here.

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[15] Comparing the salaries of vocational trade graduates with the salaries of technical course graduates is somewhat suspect, since it could be argued that from the individual's point of view the two training choices are not substitutes.

Chapter V

FURTHER CONSIDERATIONS OF THE VOCATIONAL PROGRAM IN WORCESTER, MASSACHUSETTS

The Dropout Problem, Hiring and Promotion Practices of Local Firms, Mobility of Vocational School Graduates

Introduction

All of the tentative conclusions reached in Chapter IV were closely related to the fact that in the city of Worcester, Massachusetts vocational education was much more expensive than regular high school education. The basic assumption of the chapter was that the entire benefit stream was measured by lifetime income. The return to any investment in education resulted in increases in lifetime income and these increases measured the return to the investment. It was argued that if the same increase in lifetime income could be achieved in regular high schools at a cost lower than that in vocational high schools, educators in Worcester should invest their limited funds in regular high school education. It was argued further that only if vocational education resulted in lifetime income streams which equated the present value of the differences in income with the present value of the extra costs involved, would vocational education appear as attractive an investment as regular high school education.

However, it is not clear that the total cost of the vocational education program ought to be considered an investment in high school education. It is possible that only part of the total cost of the program should be counted as a simple investment in high school education. The rest of the cost could be considered a social investment of a slightly different kind; it could be considered a social investment in dropout prevention.

When the entire cost of the vocational program was considered an investment in high school education, it had to be evaluated relative to regular high school. The cost of each year of vocational education was some multiple of the cost of each year of regular high school education. The total cost of the vocational program was the same multiple of the total cost of the regular high school program. Hence, if the difference in total benefits of the two high school programs as measured by increments in lifetime income were compared with the differences in the cost of the programs, it was not clear that vocational education would be as profitable an undertaking as regular high school education.

But the difference in costs between the programs could also be taken as a measure of the cost of preventing school dropouts. That is, rather than an alternative method of providing high school education, vocational education could be considered a method for keeping children in school. The extra cost of this effort would then be compared with the extra benefit resulting from the effort. The benefits could still be measured by increases in lifetime income; they would be the marginal increases in income which resulted from remaining in school and graduating, rather than dropping out at the end of the tenth or eleventh grade.

The difference in the two approaches should be clear. In the first approach, the increases in lifetime income which result from two different kinds of high school education are compared with the costs of these two types of education. In the second approach, the increase in lifetime income which results from completing high school rather than dropping out, is compared with the extra cost of keeping students in school. Investigation of this benefit-cost relationship might put vocational education in a more favorable light.

There are several other considerations which could also modify the conclusions reached at the end of Chapter IV. The starting wage differentials represent only one year of data, and obviously more data should be collected over longer periods of time. It is possible that vocational graduates enjoy advantages which may increase the probability of their earning more than regular high school graduates over the course of their working lives. Moreover, there may be unique external benefits which accompany the investment in vocational education and such external benefits would add to the return to the investment in this type of an education. Increased lifetime income could no longer be treated as the only category of returns. On the other hand, there may also be external costs to the program beyond the economic costs already estimated. The effects of vocational education on the mobility of the labor force would be one of these external considerations.

The intention in this chapter is to discuss some aspects of these questions. The dropout problem will be analyzed. Data pertaining to the hiring and job advancement of vocational graduates will be discussed at length. Finally, the question of external benefits resulting from increased worker mobility will be analyzed to the extent commensurate with the amount of data available.

The Dropout Problem

For a variety of sociological and economic reasons, prevention of high school dropouts has, in recent years, become a national goal. Educators have sought to identify the so-called "potential dropouts" and to propose various plans which aim at keeping them in school. The economic argument for devoting resources to dropout prevention is related to the general problem of unemployment. People who are high school dropouts have suffered from high levels of unemployment. In all cases, regardless of the level of aggregate demand, the level of unemployment for dropouts is greater than that for high school graduates. In devoting extra resources to keeping students in high school, it is hoped that the unemployment level of those who would otherwise have dropped out of school will be reduced. Clearly, extending the argument leads to the very dubious conclusion that the unemployment rate in the economy as a whole could be substantially reduced by increasing the number of years of education given the labor force. The only assumption made here will be that potential dropouts who are prevented from leaving school, can reduce the probability of their being unemployed to that of the average high school graduate.

It has been argued by G. Mangum that the vocational school is geared to providing a type of extra training for three kinds of dropout-prone students. to quote Mangum:[16/]

> "1. About one-quarter of the population have IQ's below 90 and appear intellectually unable to handle and profit from the normal high school curriculum.
>
> 2. An even larger group are products of environments so socially and economically deprived that they are totally unprepared, though intellectually capable of competing in normal school environment.
>
> 3. Even among those from more advantageous backgrounds, a high percentage do not plan to pursue higher education and find little of interest in the normal high school curriculum. These, too, are dropout-prone, unless provided with, to them, more challenging experience."

[16/] Mangum, G. "Vocational and Technical Education in the Labor Markets of the Future." A speech prepared for the Senate Sub-Committee on Employment and Manpower.

Neither the Worcester Boys' Vocational High School or the Girls' Vocational School can attempt to provide a service to those people mentioned in Mangum's first group, since the state requires all who apply for entrance to the vocational schools to take entrance exams and score 90 or above on this intelligence test. Only in exceptional cases will individuals who have scored below 90 be allowed to enter.

Nevertheless, vocational educators in Worcester and in Massachusetts as a whole claim that the vocational school program is aimed at preventing dropouts. This is seen as a major benefit of the program and so it might be claimed that vocational education is offered in order to serve those people mentioned in Mangum's second and third groups.

In order to begin to measure the success of the vocational school's attempt to prevent dropouts, a procedure used by B. Weisbrod[17/] is adopted here. Weisbrod attempted to evaluate a dropout prevention program conducted in St. Louis, Missouri. He assumed that the difference in dropout rates between one group of students considered dropout-prone but receiving no special consideration, and an identical group preceiving extra school services, can be attributed to the success or failure of the extra services provided. He then compared the cost of these extra school services, per dropout prevented, with the benefits of the extra lifetime income which accrues to those who complete high school rather than drop out.

Weisbrod's evaluation had many of the advantages of a controlled experiment. The two groups of students studied were supposedly of the same

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[17/] Weisbrod, B., "Prevention of High School Dropouts, Measuring Benefits of Government Investments, Papers presented at a conference of experts held November 7-9, 1963, ed. Robert Dorfman, The Brookings Institution (1965), p. 117.

tested intelligence rating. Further, the actual number of dropouts from both the group receiving special attention and the control group, was recorded and thus made easily accessible.

In dealing with the Worcester situation there are two conditions: first, the dropout track is assumed to be the Commercial High School program for boys and, since the dropout rate for this group will be compared with the dropout rate for the Boys' Vocational High School, it has been assumed that dropout-prone students face the choice of entering either the commercial or the vocational programs; second, it is assumed that the IQ of vocational students does not differ significantly from the IQ of boys in the commercial track. Vocational school authorities will contend that vocational students are more intelligent than commercial students, but the weaker assumption, that vocational students are no less intelligent than commercial students, suffices here.

The analysis begins with a comparison of withdrawal and dropout rates for the two high school systems. The regular high schools experienced an average annual withdrawal rate of 27%.[18/] That is, each year approximately 27% of the students in the school withdrew from the class in which they were enrolled. The withdrawal could be a transfer out of the system, a case of repeating a year, or an actual dropout.

In 1961, the regular high schools had an entering tenth grade enrollment of 1771 students. Over a three-year period, of those originally enrolled as tenth graders, the schools lost 477 pupils, 131 of whom were transfers.

[18/] All school statistics in this chapter are drawn from official school records of Boys' Vocational High School, the regular high schools and WITI.

Ninety-eight pupils failed to be promoted and repeated the year's school work. Finally, 248 pupils, or 52% of the total number of withdrawals, dropped out of school. Since the withdrawal rate was 27% it is evident that the over-all dropout rate was approximately 14%.

As has been noted, the Worcester regular high schools were organized into the commercial, general and college tracks. Here, specifically, the dropout rate of males in the Commercial High School is the subject of investigation. While the over-all high school dropout rate was only 14% and the college track dropout rate a mere 4%, the commercial track lost 39% of its original male student body as dropouts.

The withdrawal rates for both the Girls' and the Boys' Vocational High Schools were much lower than the rate for the regular high schools. Over the three-year period 1961-64, the average annual withdrawal rate at Girls' Vocational was 16% per year and at Boys' Vocational, 7.2% per year. These figures would seem to indicate that both schools were more successful than the regular high schools in holding students in school. However, when an actual dropout rate is computed from these withdrawal rate estimates, the conclusion is not as easily reached.

The vocational school dropout rate estimate is computed only for the Boys' Vocational High School. The data which would have made it possible to compute a comparative dropout rate was not provided by Girls' Vocational School. At the Boys' Vocational School, there were 265 withdrawals over a four-year period. Of the 265 withdrawals, 47 were transfers and 218, actual dropouts. Whereas in the regular high schools only 52% of those withdrawing were actual dropouts, at the Boys' Vocational School a full 82.5% of those withdrawing were complete dropouts.

It must be noted at this point that the vocational school data is for a four-year period, not for one class over four years. In any case, it appears that the potential dropout tends to select the Vocational School. One class can be traced over that four-year period at Boys' Vocational and it will be found that of an entering 9th grade class of 176, only 123 graduated. This would indicate a dropout rate of 30%, unadjusted for possible transfers. If it is assumed that only 82.5% of those lost actually dropped out, a dropout rate of 24.9% results. This dropout rate of 24.9% compares with an over-all dropout rate of 14% for the regular high schools and a specific dropout rate of 39% for the Commercial High School.

To evaluate the Boys' Vocational dropout prevention program, the vocational and commercial tracks are compared. Only males are considered and all dropouts prevented are assumed to be white. The latter assumption is reasonable insofar as it is certain that no Negroes attend Boys' Vocational School.[19]

Students choosing the vocational track must do so at the ninth grade level, while those choosing the commercial track at the regular high school do so at the tenth grade level -- a fact that requires us to further refine the vocational track dropout rate.

The commercial track had 158 entered students and, three years later, 62, or 39% of the original group, had dropped out. This compares with an over-all high school dropout rate of 14%. The vocational school accepted 176 at the 9th grade level and, at the beginning of the 10th grade, 12 1/2% of that class had left school while 152 students remained. If the yearly dropout rate had continued for three years more, the over-all dropout rate would have been 39% of the original class of 176. However, if we consider the 10th through 12th years, the vocational school lost only 21% of its class while the commercial school lost 39%. The differential dropout rate is 18% and it could be argued simply that 27 students -- 18% of the 152 -- were prevented from dropping out of school by taking the vocational track.

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[19] The total Negro population in Worcester was 2,013 in 1960, or about 1.1% of the city's population of 185,000. According to 1960 census figures, 54 male Negroes were in the relevant 15-19 year age group. If we assume 1/5 were 15 year olds in 1960, which is the year the 9th grade class with which we work was chosen, this leaves 11 possible male Negroes in the terminal track. This maximum estimate of 11 assumes all male Negroes were in this track. Presumably the actual number would be somewhat lower; perhaps 50% is a good estimate. In this case, 6 would have entered the terminal track out of a total class size of 158, or 3.8%.

The actual case is somewhat more complicated. Of the original 158 in the commercial track, 11% had remained in school but had been retarded one year, so that they had neither dropped out nor graduated at the end of 3 years. The vocational school had a full 26.2% of its original 152 who fell into this category. Thus, in all, 47% of the 152 in the vocational school either dropped out or did not graduate in three years, and 50% of the original 158 in the commercial track either dropped out or did not graduate. The difference between the tracks is clearly in the degree of effectiveness with which the vocational track can keep people in school by allowing them to proceed at a slower but far more costly pace.

The Costs of Dropout Prevention[20]

For the 1963-64 school year the public cost of providing the extra school services at Boys' Vocational High School was $678 per pupil enrolled. This is simply the difference between the 1963-64 public per pupil costs at the Boys' Vocational School and the 1963-64 public per pupil costs at the regular high schools.

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[20] A detailed cost analysis can be found in Appendix II. Here, only the results of the cost calculations are presented.

In order to compute the total amount of extra public funds spent on the Boys' Vocational School students, the entire three-year cost of educating the vocational class of 1964 must be computed. Next, the total public cost of educating the males in the Commercial High School class of 1964 must be computed. The total public cost estimate for Commercial High is then subtracted from the total public cost estimate for Boys' Vocational High. The result is an estimate of the extra funds spent to prevent dropouts from the vocational track. This estimate of the cost of dropout prevention is then divided by the number of dropouts prevented, and a cost per dropout prevented is obtained.

Obviously, the cost per dropout prevented is directly related to the number of dropouts actually prevented. The first set of assumptions yielded a result of 27 dropouts prevented. If the total public cost of extra services is divided by this figure, a cost of $10,900 per dropout prevented is the result. The ordinary per pupil costs for the regular school services provided by the vocational school must be added to the estimate of the per pupil costs of extra school services. In this case, the ordinary three-year costs per pupil graduating were $1,585. Adding this $1,585 estimate to the $10,900 estimate yields a total undeflated three-year cost of $12,485 per dropout prevented.

The cost of dropout prevention can be computed by using several other sets of assumptions. Specifically, it can be assumed that the entire vocational entering class would have dropped out of school except for the extra social services provided by the program. Under this assumption, the number of dropouts prevented rises from 27 to 123, the total number of vocational graduates. The cost per dropout prevented then falls from $12,485 in current dollars to $3,985 in current dollars.

Next, it can be assumed that the number of pupils actually prevented from dropping out is that number graduating and then accepting employment in an occupation for which they were trained in the school. This assumption implies that those who graduate but, for whatever reason, do not find employment, cannot be said to have been kept in school because of the extra services made available to them. The number of vocational graduates finding jobs was 108. If we count all 108 as dropouts prevented, the three-year public cost per dropout prevented is $4,315 in current dollars.

The Benefits of Dropout Prevention

The benefits to be measured here are the marginal increases in lifetime income which result from graduating from high school rather than dropping out at the tenth or eleventh grade level. These increases in lifetime income are only the direct benefits associated with the investment in education.

Weisbrod had computed the value of these direct benefits in his study of the St. Louis program and his estimates of lifetime income will be utilized here. For northern white males, the differential lifetime median income between those dropping out at 16 years of age and those graduating has a computed present value, at a 5% discount rate, of $3,420 in 1949 dollars. Since this figure is in 1949 dollars, it will be necessary to deflate the cost estimates from current dollars to 1949 dollars. The estimate of direct benefits is then compared with the estimates of costs and three different benefit-cost evaluations are obtained. The results of the calculations are shown in Table 18, below.

The first result from Table 18 is not encouraging. When it is assumed that only 18% of the vocational class was saved from dropping out, the measured public costs clearly exceed the measured benefits. However, if it is

Table 19

Direct Benefits and Public Costs of Dropout Prevention
Boys' Trade School -- Class of 1964

	(1) Assuming 18% of the vocational class was prevented from dropping out	(2) Assuming the entire vocational graduating class was prevented from dropping out	(3) Assuming all those who graduated from the vocational school & found jobs in the occupation for which they were trained were prevented from dropping out
Resource Cost per Dropout Prevented			
Direct Prevention Costs	$8,178	$1,803	$2,027
Additional Instruction Costs	1,187	1,187	1,187
Total Resource Costs	9,365	2,990	3,214
Direct Benefits per Dropout Prevented			
Increased Present Value of Lifetime Income	3,420	3,420	3,420
Total Costs (per Dropout Prevented) Not Covered by Measured Benefits	5,945		
Amount by Which Measured Benefits Exceed Measured Costs	---	430	206

Source: Office School Records of Boys' Trade and the Regular High School assumed that the entire graduating class was saved from dropping out, the measured benefits exceed the measured public costs. Finally, if the assumption is made that all those who graduated from the vocational school and found jobs in the occupation for which they were trained, were prevented from dropping out, again the measured benefits exceed the measured public costs.

The conclusion of this section is clear. If public decision-makers are willing to consider vocational education an investment in dropout prevention and to count every vocational graduate as having been saved from dropping out of school, the investment is worth undertaking. The unanswered question is whether the same sort of dropout prevention could be achieved at lower cost and hence greater net benefit.

Hiring and Promotion Practices of Local Firms

The sample of starting wage differentials could not indicate whether vocational graduates and regular high school graduates were regarded by employers as qualitatively different groups of individuals. The small premium in starting wage paid the vocational graduate relative to the regular high school graduate, may not indicate the advantages enjoyed by the vocational graduate. It is possible that the vocational graduate can advance, once inside the firm, at a much more rapid pace than the regular high school graduate. More important still, some firms may deliberately seek out only those individuals with backgrounds in vocational education. The sample of firms used to discuss starting wage differentials can also be used to illustrate the hiring and promotional practices of these firms.

The period June 1964 to June 1965 was one of economic recovery in Worcester. Total new hires among the twelve firms during this one year period were 945. Together, the Boys' Vocational School and WITI contributed

71 people, and the regular high schools, 23 people. The twelve firms accounted for 47% of all those placed in jobs by the vocational school and WITI. Two of the firms accounted for 59% of the twelve firm total. Hence, these two firms employed 28% of all those placed by Boys' Vocational and WITI. In Table 19, below, the twelve-firm total number of new hires is recorded.

Table 20

Total Firm Employment		No. of Firms in Sample	Increase in Employment June-June	Total New Hires	Total Boys' Trade WITI	HS
	1000	2	108	324	42	0
500	1000	3	373	431	9	10
200	500	2	54	93	7	10
100	200	3	65	85	10	3
50	100	1	6	6	2	0
25	50	1	0	6	1	0

Source: Independent field survey conducted by research staff.

It must be emphasized that the totals entered under columns 4 and 5 represent people hired directly from either the Vocational School or the regular high school. People bid away from other firms, or re-entering the work force after having been involuntarily unemployed may very well have vocational backgrounds or have been recently graduated from high school. However, these people would be included under column 3 entries. The firms' hiring policies and their methods of active recruitment are significant; a policy of actively seeking employees from the public high or vocational schools would seem to differ from a policy which seeks to attract workers through other means.

The firms in this group did very little hiring directly from the high schools. As was noted earlier, they were interested primarily in hiring potential machinists, and so it would appear that the vocational schools did provide a service for those planning to enter the machine and tool industry in Worcester. But a closer look at individual firm hiring policies is necessary at this point.

The Ports of Entry

Whether or not a firm had hired directly from the regular high school, it quite clearly tried to distinguish between the ports of entry to the firm open to the regular high school graduate and those open to the vocational school graduate. The firms were interested in assemblers, utility men, ordinary plant laborers, machine operators and machinist trainees -- all shop positions. If hired for general office work, the regular high school graduate was eligible for an office boy position. One firm hired high school graduates for low-level management trainee programs leading to positions in the shop. The high school graduates hired for shop work could expect jobs as assemblers, utility men, machine operators or laborers. The vocational graduates could expect to be hired as machinist trainees or machine operators though it was possible to be hired as utility men, machine operators or laborers.

The composition of the internal labor market of the firm, and the relationship between the internal and external market reflected in firm upgrading procedures, determined what advantages the vocational graduate enjoyed relative to the advantages of the regular high school student. None of the firms in this group had a union. This is not unusual in the Worcester area, though the lack of unionism makes the area atypical in the manufacturing sector of the national economy. Such an absence of unions left the firms of this study with maximum flexibility in establishing hiring and upgrading policies.

While vocational schooling was sometimes treated as a necessary condition for entrance into machinist training, it was not always a sufficient condition. Even though employers distinguished between the ports open to regular high school and those open to vocational students, often the actual difference was the rung of the internal ladder the vocational student was hired at, rather than the port itself. For example, a high school graduate would be hired as a machine operator, and a vocational graduate as a labor grade II machine operator. In both cases the port of entry is the same, with the vocational student given a higher labor grade rating as a result of the training completed at public expense.

All of the firms expressed a preference for in-plant upgrading. This left the ports of entry for new hires at relatively low skill levels. The one firm able to make the clearest actual distinction between vocational and regular high school entry ports, hired regular high school graduates as assemblers or utility men, and vocational graduates as machinists at the lowest end of the labor grade.

The difference between this one firm and the others studied, lies in the extent to which it could effectively keep the advancement path of the vocational graduate separate from that of the regular high school graduate. The firm hired both graduates at the same starting salary level. However, at the end of a successful three-month trial period, the vocational graduate received a pay boost and began to advance along the labor grade path set for company machinists. The regular high school graduate received a pay boost, but his advancement could only be along the path set for assemblers or utility men.

This firm had a plant-wide bidding system, as did all of the firms studied. Under the system a job opening would be posted for a three-day period. If plant employees expressed a desire to be considered, final selection would be based on seniority. However, the regular high school graduate could not bid for a machinist opening. Therefore, in that one firm, an individual could not expect to move freely, once inside the firm. The lack of horizontal mobility inside the firm was the primary reason that vocational education had become a sufficient pre-condition for a career as a company machinist.

However, in another case, company in-plant upgrading policies actually resulted in the reverse situation. The fact that an individual was a vocational school graduate made it less likely that he would be hired as a machinist trainee. Theoretically, the company was willing to hire vocational graduates as machinist trainees at a starting salary slightly above the company-wide minimum for factory employees, but in actual practice, in-plant upgrading policy made this virtually impossible. Regular high school graduates were hired and trained for simple machine operations, and if an opening for more advanced machine operation became available, the bidding system allowed the regular high school graduate to advance to it. Although the company considered the vocational graduate ready for the position, it could only hire at the high school entry level then vacated. The entry salary was not competitive with what could be earned by the vocational graduate elsewhere, and so he was not willing to be hired. Thus the choice of the vocational school program actually inhibited the graduate's chance of a machinist career.

The usual practice in the other firms studied resulted in the vocational graduate's receiving a higher starting salary and a more sophisticated machine to operate. However, efforts to preserve non-union status made firms very conscious of internal upgrading. Hence, high school graduates could not be excluded from machine training, once inside the plant. If the firm had a large assembly division, the high school graduate would be likely to be hired in that division and perhaps remain, but he could frequently be transferred. If all work was of a kind similar to that of machine operator, the vocational graduate's only advantage was the differential starting wage.

It may be that the probability of being hired by these firms directly from high school is higher in the case of the vocational graduate. However, once in the labor market, the regular high school graduate may be an equally acceptable candidate for training. The two largest firms in the labor market had established a rule of thumb making vocational school training a prerequisite for all those who wished to be hired for machinist training directly from high school. But in one case the firm also hired vocational graduates for utility or laborer positions and allowed regular high school graduates at the same port of entry. Either could then be transferred into machine training. Some vocational graduates would be under-utilized until machine trainees were needed, and then transferred. Some were hired simply because their labor price was the same as that of the regular high school graduate and their training made them preferred at that price. The other company simply offered two training wages and the vocational graduate was hired at the greater wage. Again, although the regular high school graduate was not hired upon graduation, those already in the labor market were hired as grade no. I trainees.

Finally, the machinist training given in these companies may lead, but cannot be said inevitably to lead, to the actual machinist trade. Each of these firms has a limited number of jobs occupied by what are called set-up men. The set-up man can run any of the various machining tools. Further, he plans out machining jobs from the blueprint state. These companies pointed to the set-up position as an eventual goal for some graduates of the vocational school. Thus it appears that most vocational school graduates are employed as machine operators rather than actual machinists.

The problems facing graduates of the machinist programs are not as great as those facing graduates of some of the other programs offered at Boys' Vocational or at WITI. In some cases graduates are faced with the problem of union apprenticeship rules. The presence of a union or a union apprentice program can change the entire nature of the hiring process. The graduates from the vocational school's electrical program are faced with the constraints imposed by the apprenticeship rules of the Brotherhood of Electrical Workers. Consequently, vocational graduates are hired at electrical firms as utility men and, in one case, as truck drivers. The utility or driver's job is actually a probationary work period which varies in length from six months to two years. If the firm has room for a new apprentice, the proportion of journeymen to apprentices is set by the union, and if it chooses, it can nominate this vocational graduate for an 8000 hour apprentice program. The new apprentice signs an agreement with the apprentice committee, not with the company, and may very well change jobs. He may be forced to find another firm if the ratio of journeymen to apprentices changes because the original employer loses one or more journeymen.

The vocational training has in this case simply been used as an indication of career choice by the employing company. It hires the vocational graduate because it recognizes the immobility of workers whose only possible access to an apprentice program is a pre-apprentice work period with that firm. The vocational training has provided the individual some opportunity to enter the electrical trades but the union has rendered the actual training received in that program almost unnecessary. In any event, the apprentice course necessitates the repeating of any course of shop work accomplished during the high school years. Moreover, the fact that vocational school graduates are hired and later nominated for apprentice programs does not imply that high school graduates are not hired. Unions often add their own rules for the selection of possible apprentices, and in the electrical trades, hiring of a journeyman's son for later nomination to the program is not common.

This type of utilization of the vocational school wherein the vocational track is regarded merely as an expression of career preference and not as a substitute for on-the-job training, is common throughout the building trades. The plumbing and sheet metal trades require the same type of extended apprentice training as the electrical trade. Firms are again limited as to the number of apprentices they can employ at a given time. Whereas in the electrical and sheet metal trades the apprentice program runs for four years, the plumbing and heating program runs for a total of five. One firm picked all its apprentices from the WITI or trade schools; in other firms the union played a major role in the selection process. It would appear that the public could provide means of selecting apprentice trainees without having to provide four years of shop work merely to clearly identify potential enrollees. People who successfully passed a series of mechanical aptitude tests would provide fully as many qualified applicants.

The Geographic Mobility of the Vocational School Graduate

Potentially, the vocational school could increase the geographic mobility of the work force in the region it served. Conversely, it could serve to reduce the geographic mobility of the work force in that same region and lastly, of course, it could have no effect positively or negatively on the geographic mobility of the work force.

If the vocational school programs increased worker mobility either within the region served or from the region to other surrounding regions, these increases could be considered an external benefit of the programs. The school's training programs could be helping the labor force respond to regional shifts in the demand for labor. Whereas untrained workers might be unsuccessful in finding employment, vocational graduates might respond readily to job vacancies anywhere within the region. Moreover, having been trained, they might be willing to migrate outside the region in order to utilize their skills. If, however, the school actually decreased the amount of migration out of the region, local firms might benefit at the expense of surrounding areas. A look at the geographic mobility of the class of 1964 will be revealing.

In June of 1964, 79 students graduated from the Boys' Vocational School and 93 from WITI. Of the 79 graduated from Boys' Vocational, the school claimed to have placed 58 in the occupations for which they had been trained,[21] and an additional two people in occupations not directly related to the training they had received. Twelve members of the graduating class entered the armed services. Six members of the class had decided to continue full-time schooling. There were an additional 52 people who were hold-overs who had not completed their shop work. By May of 1965, sixteen of these hold-overs had been placed by the school. Three of the hold-overs had graduated and entered the armed service, and five had dropped out of school.

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[21] It is not possible to verify the placement claims of the school insofar as investigators found that, in some instances, people, recorded as placed, actually were hired at the gate. However, in most cases employers did call the school to request graduates, and in all cases people hired at the gate offered their vocational backgrounds as inducement for hiring. Hence all 150 will be treated as placed by the school, despite the obvious qualifications.

WITI placed 74 of its 93 graduates in occupations for which they had been trained. One person took a job unrelated to his training. One person found himself unemployed upon graduation. Fourteen graduates entered the armed forces and three continued their full time schooling.

The total number of graduates of Boys' Vocational High and of WITI placed in occupations for which they had received training was 150. Of the 150 employed, 99 were placed within the city limits of Worcester. Thirty-eight people were placed outside Worcester but within the Worcester Standard Metropolitan Statistical Area, and 13 were placed outside the Standard Metropolitan Statistical Area but within the State. Fifteen of the 38 placed in the Standard Metropolitan Statistical Area were placed in towns which bordered Worcester, and no graduate found a job outside the state. This meant that approximately 66% of those placed in jobs were placed within the city limits. Twenty-five per cent of the graduates were employed outside Worcester but sill within the Standard Metropolitan Statistical Area. Only 9% of the graduates moved outside the Standard Metropolitan Statistical Area to find a job. This geographic distribution of graduates can be explained in part by the hiring practices of local firms and in part by school policies.

Firms in Worcester often attempt to hire the best potential workers part-time during their high school training. In some cases the firms are enabling the student to finish his high school training by providing the necessary minimum personal income he needs to remain in school. This type of school-firm arrangement has the further effect of reducing at least the immediate geographic mobility of the graduating class. Students who have been working steadily at a local plant are not ordinarily receptive, upon graduation, to relocation outside the local labor market. Moreover, firms in Worcester often employ vocational school instructors during the summer. The instructors become familiar with local firm production methods and, in some cases, arrange for the use of scrap materials in the vocational school shops. Since instructors play an important role in the placement of graduates, this type of instructor-firm relationship helps to encourage the placement of graduates in local firms.

These local preferences, which are the result of local firm policy, are further reinforced by the actions of school authorities. The announced policy of the school is to place people in jobs in the community where they live. Thus attempts are made to keep in Worcester those already living in Worcester and attending the vocational or technical school. People from surrounding communities are placed in their respective communities. A shift in the demand for labor even within the SMSA would not be met by the school attempting to encourage worker migration to the new site. If the school attempted any response, it would have to take the less direct method of encouraging increased enrollments from the area of increased labor demand. The school is forced to this type of policy function because of the system of intra-city subsidies in the form of tuition charges. Each out-of-town pupil must pay a tuition charge to the school. His respective town pays the fee, but this very fact leads to the false conclusion on the part of school authorities that visible proof of the school's success is necessary. Hence, there is an attempt to return graduates to the towns who have paid the tuition fees. Although the school is not always successful, the policy is clear enough. If, in fact, skilled workers were needed outside the limited geographic area now served by the school, state policy would call for creation of a new school near the site of new industrial development. No thought would be given to transferring graduates out of the SMSA labor market.

In 1963-64, 67.16% of all students enrolled at Boys' Vocational High and at WITI were residents of the city of Worcester. In the same year, 32.84% of those enrolled were residents of communities outside of Worcester. In other words, 66% of all those placed at jobs by the school in 1964 were placed within the city limits of Worcester. This attests to the effort made by the school to place people in the communities in which they live. Thus it appears that the school does not attempt to increase intra-regional worker mobility. Further, given the plan of placing graduates in jobs in the communities in which they live, it does not appear that the school attempts to facilitate inter-regional mobility. It is possible that these efforts to keep graduates within the region would be beneficial to local employers. The fact that local firms can rely on the vocational school for a small but consistent flow of partially trained workers, may cause some firms to remain in the area. If this is the case, the benefits gained by the region at the expense of other regions may offset some of the costs of the program. In order to establish this as more than a possibility, it would have to be shown that existing firms would consider re-locating and that new firms would not consider locating within the region if the school were removed.

Inter-generational Mobility

The question of inter-generational mobility is equally interesting. It is important to know whether the vocational school upgrades the skill level of its students relative to the skill level of the fathers of these students. If most students come from blue collar backgrounds and choose white collar training programs, inter-generational movement from blue to white collar occupations could be assisted by the school.

The Worcester Industrial Technical Institute provides a good framework in which to examine this question. Students entering the school can choose from among fifteen program offerings, some of which lead to occupations falling within the white collar category. There are other training programs which are definitely in the blue collar category. In Table 20, below, are the percentages of WITI graduates of 1964 who chose white and blue collar training programs. The same table contains the percentages of the fathers of these graduates whose occupations fell in blue or white collar, service, or farm categories. If we compare the occupations of the fathers with the career choices of the sons, an interesting picture emerges.

Table 21

Distribution of the Labor Force

	1960 U.S. Labor Force % Distribution	Worcester SMSA % Distribution	Graduates WITI % Distribution	Fathers' of WITI Graduates
White Collar	42.3	36.2	53.5	17.4
Professional Technical Kindred	11.4	11.2	53.5	8
Managers, officials, proprietors	8.4	10.0		
Clerical & kindred	15.0	7.4		
Sales	7.5	7.6		5.4
Blue Collar	39.6	52.4	46.5	78.6
Craftsmen-foremen	14.3	22.3	43.2	56
Operatives	19.9	25.6	3.3	16
Laborers	5.4	4.5		6.6
Service	11.8	6.7		4
Private household	2.8	.1		
Service workers	9.0	6.6		4
Farm Workers	6.3	4.7		
Farmers & farm managers	3.9	4.1		
Farm laborer's & foremen	2.4	.6		

Sources: 1) Department of city planning, City of Worcester.
2) Official School Records of WITI.

Ten of the eleven trade courses lead to occupations falling within the craftsmen and foremen category. The entry level for most of these trades could more accurately be described as apprentice training and would fall under the operative classification. However, the goal of the program is to place people in the fully skilled occupations and the graduates are classified by program goal rather than by entry level occupation.

The graduates were divided into several occupational categories, with 46.5% counted as Blue Collar workers and 53.8% as White Collar. Most of the Blue Collar workers fell into the craftsmen category with 3.3% of them classified as operatives and none in the laborer classification. The other 53.5% were all in the professional-technical category of White Collar worker. In contrast, only 17.4% of the fathers of these graduates were White Collar workers, and only 8%, professional or technical. The greatest number were Blue Collar workers (78.6%) with 56% craftsmen or foremen, 16% operatives and 6.6% laborers. Only 4% fell into the Service category and none were Farm Workers.

It would appear from this set of observations that, if the school were successful, it would be aiding the inter-generation movement of workers from Blue to White collar occupations. It would be aiding a similar movement of workers from the unskilled laborer or semi-skilled operator classes to the skilled and professional-technical manpower levels. Interestingly, although Worcester's SMSA is quite rural and 4.1% of the labor force is made up of farmers and farm managers, no graduate came from a farm family background. Thus the school had been singularly unsuccessful in serving as a training center for youth moving off the small rural farm and into the industrial and population center.

Summary

Consideration of several additional aspects of the vocational program has not led to wholly satisfying conclusions. The success of the vocational school as a dropout prevention mechanism could not be considered impressive. Only under the most liberal of assumptions did the benefits of the program somewhat outweigh the costs. Hiring and promotion patterns in local firms indicate that the position of the vocational graduate is not markedly more favored than that of the regular high school graduate. While the school may help the vocational graduate find a job, his advancement inside the firm is apt to follow the same path as that of the regular high school graduate. Finally, the Worcester vocational schools could not possibly be aiding the intra-regional movement of workers and does not appear to be aiding movement of workers within the region though granted that this immobility might be of some benefit to local firms. The only relatively successful outcome of vocational education was in the area of the inter-generational movement of workers. Even here, however, the success of WITI depends on the extent to which career choices of its enrollees turn into actual career paths.

Chapter VI

SUMMARY

Some Implications for the Future of Vocational Education

This study has attempted to set up a framework for analysis. It has treated vocational education as an investment which competes for community funds with other forms of educational investment. It has assumed that the local community or the local region approaches its educational investment in an economically rational manner: educators receive a limited amount of funds from higher governmental authorities and they seek to allocate these funds optimally so that the total return on their investment is maximized.

In order to attempt this maximization, it is necessary to measure the costs and benefits of the alternative educational investments. Educators should then attempt to maximize the net benefit per dollar expended.

The introductory chapter describes in detail the kinds of costs and benefits which accompany any local investment in education and points out, in particular, the kinds of costs and benefits associated with vocational education. It attempts to describe the procedure that must be followed in order to make a cost-benefit evaluation of any educational program. In the light of this, it describes the procedure followed in the present attempt to evaluate vocational education.

Chapter II describes the institutional setting in Worcester, Massachusetts, where the vocational education program was selected for the subject of analysis in this particular study. The vocational education programs in Worcester and in the state as a whole are described, as well as the city's regular high school system in relation to the system of vocational education. Finally, the actual administration of vocational school programs is discussed in detail.

Chapter III deals with the total resource costs of vocational high school education, regular high school education and post-high school vocational-technical education. It is seen that the public per pupil costs of vocational education for males, whether at the high school or post-high school level are 2.3 times those of regular high school education. The per pupil cost for female vocational education is 1.8 times that of regular high school. When private direct costs are added, male and female vocational education is, respectively, 2.15 and 1.75 times that of regular high school education. When private opportunity costs in the form of foregone earnings are added to these public and private cost figures, the cost ratios are reduced. Male vocational education is now 1.4 times as expensive as regular high school education, and female vocational education, 1.25 times as expensive. The balance of this chapter is concerned with the sources of the differences in costs between regular and vocational high school education. The labor intensive methods used in education are a matter of special concern.

The cost ratios established in Chapter III lead us, in the next section of the study, to some interesting cost-benefit relationships. Decision-makers at the local level are faced with a choice between two kinds of high school education. Whether or not foregone earnings are included in the comparative cost estimates, vocational education is still more expensive per pupil than regular high school education. The actual difference in costs between vocational and regular high school education remains the same whether foregone earnings are included or excluded, as long as it is assumed that foregone earnings for vocational students are the same as the corresponding foregone earnings for regular high school students.

In order for the decision-maker to prefer this more expensive kind of education, graduates of the vocational program would have to earn somewhat more than graduates of the ordinary high school program. The extra earnings accruing to the non-college bound vocational graduate relative to the non-college bound regular high school graduate would have to be such that the present value of these extra returns would be just equal to the present value of the extra costs incurred.

Just how the earnings of vocational high school or post-high school students compare with regular high school graduates and with one another is an empirical question. This study uses starting wage data to compare the Boys' Vocational High School program with WITI, the boys' post-high school vocational program, and with the regular high school program. It also makes use of data describing the work experience of graduates from Girls' Vocational High School in order to ascertain how well graduates of girls' vocational schools fare in the labor market.

The empirical data revealed that, at least initially, vocational graduates earn slightly higher wages than untrained regular high school graduates. This is the case if the starting pay of vocational school graduates employed at jobs in their trade areas is compared with the pay of ordinary high school graduates hired in these same trade areas. The size of the premiums paid the vocational high school graduate, relative to the regular high school graduate, varied inversely with the size of the firm hiring.

In the smaller firms, the starting wage differentials were of a magnitude sufficient to insure the possibility that present values could be equated within 6 to 12 years. The number of years required varied with the rate of discount employed, and the calculation assumed that the starting wage differential remained constant over that time period. In the largest firms the starting wage differential was not sufficient to equate the present value of extra costs and benefits at any of the rates of discount employed.

It was argued that these starting pay differentials would very likely decrease over a time. At the end of a given time period -- perhaps five years -- the regular high school graduate would have acquired at least as much on-the-job training as the vocational graduate. Thus the initial advantage enjoyed by the vocational graduate would be lost. Give the initial wage differentials, all calculations which allowed these differentials to decrease, and required that the present values of extra costs and benefits be equated by the time the differentials became zero, resulted in non-recovery of extra costs.

Hence the decision-maker in education is faced with a difficult choice. If wage differentials do not increase with time but merely remain constant or decrease, vocational education for boys may not be as profitable a venture as regular high school education. Investigation of union practices and plant upgrading procedures lent further weight to the argument that these wage differentials would not widen significantly over the course of the graduates' working life.

However, this study of starting wage differentials was limited to beginning wages of vocational graduates and regular high school graduates employed in the same trades. Perhaps the vocational graduate should also be compared with the non-college bound high school graduate who was not employed in the same trade. Such a comparison would no longer attempt to estimate the value of vocational education as a substitute for on-the-job training, but would include some notion of the structural unemployment argument. That is, if vocational education results in employment while graduation from regular high school results in long periods of unemployment, all of the extra costs incurred would quickly be recovered. This study did not attempt to evaluate vocational education as a method of decreasing unemployment among non-college bound teen-agers. Hence the decision-maker's choice between regular high school education and vocational education is not clear-cut.

Wage data for graduates of the girls' trade programs revealed that most graduates earned the federal minimum hourly wage, but no more. Further, as might be expected, attrition rates were high for this group of workers. In most cases less than one half of those originally taking jobs upon graduation from high school were still working eighteen months later. It appears, therefore, that this type of vocational education is even harder to justify than the investment in vocational education for boys. Certainly, workers who earn only the federal minimum wage could not be said to be earning more than ordinary high school graduates, no matter where those high school graduates are employed. Moreover, the high attrition rates make highly doubtful the long-term equating of present vales of benefits and added costs.

While there is possibly some choice in the course decision-makers choose to follow when investing in high school programs, there is less choice when post-high school education is considered. If the question of when vocational education should be provided is faced, private opportunity costs become central to the analysis. It is found that public decision-makers could provide two years of post-high school vocational education in addition to the four years of regular high school for the same price, in terms of public funds, as the four year vocational high school program. However, when private costs are considered, it becomes obvious that for an investment in post-high school education to be profitable, post-high school vocational students would have to earn more over the course of their working lives than their vocational high school counterparts.

Starting salaries for post-high school vocational-technical graduates were, on the average, slightly higher than those of their vocational high school counterparts though these wage premiums were not found to be large enough to justify investing in post-high school vocational education. Justification would depend on these wage differentials widening considerably over the course of the graduates' working life. Post high school graduates would have to earn considerably more than their vocational high school counterparts in the same trade.

In an effort to discover some added justification for community allocations of funds to vocational-technical education, we calculated the success of this type of education in preventing dropouts. The rationale underlying this part of the study was that vocational training could be considered an investment in dropout prevention rather than an investment in a type of high school education alternative to the regular high school. The results of this calculation showed that only if every graduate of Boys' Vocational High School was considered to have been prevented from dropping out of school was the program marginally profitable.

Finally, we tried to assess the impact of the vocational school on the geographic mobility and the intergenerational mobility of the worker. If vocational education could increase the geographic mobility of trained workers, regional labor markets might benefit significantly from the presence of a vocational school. Moreover, if it would help influence the career choices of the sons of farmers and blue collar workers, it might help alleviate some of the unemployment problems created by automated production processes. We find that vocational education does not increase geographic mobility and, in fact, may actually decrease this type of worker mobility. However, its a certain limited extent sense, it does help to facilitate the intergenerational movement of workers from blue collar to white collar occupations.

This study cannot hope to provide a final answer to as vital a policy question as vocational education. It is concerned with only one city and one high school system. The follow-up data used to investigate wage differentials between vocational graduates and regular high school graduates covers only a relatively short period of time after graduation. In some cases only starting pay differentials are discussed. Certainly, additional studies should follow vocational and regular high school graduates over longer periods of time. The number of vocational schools studied should be increased, the types of such schools should be more varied. The first aim in increasing the number of schools studied would be to decide whether the relative costs of vocational and regular high school education are close to those discussed here.

If these broader studies do not alter, but, in fact, tend to confirm the findings presented in the analysis, school authorities should give serious thought to revision of the present vocational system. The opportunity costs to the community which accompany this type of education seem to be considerable. In 1964, simply by discontinuing high school vocational training for boys, the city of Worcester could have released approximately $300,000 for alternative school programs. This was about 8 percent of the total high school budget. To be sure, given the manner in which vocational education is presently administered in Massachusetts, a decision to discontinue the program would not necessarily lead to a decision to put these extra funds at the disposal of the regular high school system. However, this very fact is probably an argument for reorganization of the educational administrative system at the local level.

Given the cost of vocational education, it certainly appears that alternative programs for publicly subsidized on-the-job training should be considered. It may be that individuals who need a work-oriented environment could spend part of their school day working in local industry. If some of the money that is now expended in providing vocational facilities were used to subsidize local industry, the success of the training might be greater and its cost, less.

Vocational education, when considered as a dropout prevention measure, encounters the same problems of excessive cost as it does when evaluated as a type competing with that of the regular high schools. The direct income benefits which result from graduating from high school rather than dropping out are simply not great enough to justify expensive vocational programs.

Indirect benefits from dropout prevention may make the vocational program somewhat more attractive from the point of view of investment. However, most indirect benefits which could be postulated as being the result of dropout prevention would be very difficult to attribute to the vocational program. For example, if we argued that dropout prevention cuts community crime costs, we would have to compute the cost difference between the crime committed by the dropout and that committed by all other criminal offenders. Moreover, we would have to prove that the delinquency and crime rates for dropouts were significantly higher than the delinquency and crime rates for high school graduates. Finally, we would have to assume that the dropouts' delinquency and crime were the result of their dropping out of school.

Vocational education in Worcester is an expensive terminal training program. This study questions the economic value of that training program.

Appendix I

The starting wage differentials are allowed to decrease over a five year period until, at the end of that time, no differential exists. The present values of these decreasing differentials are shown in the table below. A 5% rate of discount is employed. A 10% rate of discount would merely reduce the present values.

Table 22

Present Values of Decreasing Wage Differentials

Starting Wage Differential	5 Years	10 Years
$ 260	$ 614	$ 1018
360	831	1421
560	1294	2199
500	1156	1952

Source: Independent Field Survey

Obviously, only if the wage differential is greater than any observed in this study, will the present values of these extra returns equal the present value of the extra costs -- which, in this case were $2520.

Appendix II

In order to calculate the total amount of resources committed over a three-year period to the Boys' Vocational program and the commercial program, respectively, a procedure outlined by R. C. Blitz should be followed. To the current costs for each school year, implicit rent and tax loss estimates based on present book value estimates of plant and equipment, plus capital outlays for that year, must be added. The following year's calculation includes the new book value estimate as a base for rent and tax loss estimates, plus the capital outlay for that year. The process is repeated for each year considered.

Unfortunately, only estimates of the value of plant and equipment in 1963-64 were available. Hence, a fixed total implicit rent and tax loss charge is added to the current costs for the school years 1961-64. This method necessarily over-estimates the implicit costs.

There are two further assumptions which must be made in order to calculate total resource costs. The current and capital costs for any year's operation in either school is assumed to be uniformly distributed among each of the grades the school maintains. There are probably differences in the cost of educating 10th as opposed to 12th grade pupils. For the regular high school these differences could be due to smaller pupil/teacher ratios, added guidance and job placement counciling, and such direct cost items as class graduation expenditures. The vocational school would have these problems in addition to the question of allocating depreciation charges among the pupils.

On this point see: F. Machlup, The Production and Distribution of Knowledge in the United States. (Princeton, N.J.: Princeton University Press, 1962.) p. 100.

R.C. Blitz, "The Nation's Educational Outlay". In: Economics of Higher Education. Edited by S.J. Mishkin. (Washington: Office of Education, 1962.) Appendix B.

More time spent by seniors on the more expensive equipment could mean that more of the depreciation charges ought to be allocated to the senior class. Further, material supply costs would probably be higher for twelfth grade pupils, while supervisory costs would be lower. Data which would allow exact treatment of these cost variations are virtually nonexistent, and hence it must be assumed that per pupil costs for tenth graders are approximately equal to per pupil costs for twelfth graders.

Those vocational students who did not graduate but did not drop out are considered half-time students for one additional year. The costs for that year are assumed to be identical to the costs for the last year of their full-time attendance.

All of these students graduate sometime during the next academic year. Some of these students are enrolled for the entire academic year, while others graduate before the year has been completed. Since the students have only shop time to complete, and this is one half the ordinary school day, a student who completes one year of such work will have finished one half year of actual school time. To the extent that pupils do graduate before the year is completed, the estimate used to measure the cost of their education will be somewhat high.

Given these assumptions, the calculation is direct and is summarized in Table 21.

Adding the differential cost for each year of operation yields a grand total of $280,749. The differential cost of educating hold-overs at each of these schools must be added to this figure. This calculation adds $14,624 to the total; therefore the over-all difference in resource costs over the three-year period is $295,373.

Table 23

Total Differential Resource Costs

Boys' Trade, Commercial High

School Year	Boys' Trade[a]	Commercial High[b]	Differential Cost
1961-62	$ 1,097[c] Per Pupil	$ 481 Per Pupil	$ 616 Per Pupil
	152 Total Pupils	158 Total Pupils	
	$166,744 Total Cost	$75,998 Total Cost	$90,946
1962-63	$ 1,092 Per Pupil	$ 501 Per Pupil	$ 591 Per Pupil
	147 Total Pupils	127 Total Pupils	
	$160,524 Total Cost	$63,627 Total Cost	$96,897
1963-64	$ 1,210 Per Pupil	$ 532 Per Pupil	$ 678 Per Pupil
	123 Total Pupils	107 Total Pupils	
	$148,830 Total Cost	$56,924 Total Cost	$92,906

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a. The number of pupils for each year is the number who entered at the ninth grade and were still in the program at the tenth, eleventh and twelfth grade levels. These figures differ from the total number of pupils enrolled as members of the class of 1964. The latter figure includes transfers into the program.

b. These are male students only.

c. These per pupil cost estimates include implicit rent and tax loss charges.

Source: School records, Boys' Trade and Commercial High.

Appendix III

The class that graduated from the Boys' Vocational High School in 1964 was considerably smaller in numbers than when it entered in September of 1960. The class that graduated from WITI in 1964 was also considerably smaller than when it undertook training in September of 1962. The number of pupils starting and completing each training course is included in this appendix in order to illustrate the wide difference in enrollments and drop-out percentages among these courses.

At the Boys' Vocational High School, the auto repair course appeared to be a dead-end; the drop-out rate was 72%. At WITI, the auto repair course was more successful; twelve students graduated from the course. Since only four students had originally enrolled in the course, eight others appear to have transferred into it at an early stage of their training. Given the original enrollments in the mechanical technology course, it appears likely that several students transferred from the mechanical technology course to auto repair training.

On the other hand, the cabinet making course at WITI lost 75% of those originally enrolled, while at Boys' Vocational the same course lost only 12 1/2%.

Table 24

WORCESTER BOYS' TRADE - CLASS OF 1964 - YEARLY ENROLLMENTS

Enrollments	Auto Repair	Cabinet Making	Carpentry	Electrical	Machine Shop	Painting	Pattern Making	Plumbing	Printing	Sheet Metal	Welding	Totals
9th (1960-61)	32	8	14	22	50	13	8	7	5	9	8	176
10th (1961-62)	31	7	10	22	41	12	6	4	6	9	5	153
11th (1962-63)	30	7	12	25	46	11	6	6	8	7	4	161
12th (1963-64)	17	7	12	21	44	8	6	6	6	8	4	139
1. Graduates[a] (On work placement data)	10	7	6	9	31	5	3	2	2	3	1	79
2. Graduates[a] (On school records)	15	7	11	20	42	7	6	6	6	7	4	131
3. Numbers Obtaining full-time jobs within three months of graduation	5	5	6	5	26	5	2	1	1	3	1	60
4. Numbers Obtaining full-time jobs within three months of graduation - in occupations for which training was received.	4	5	6	5	26	5	1	1	1	3	1	58
5. Numbers Obtaining full-time jobs within twelve months of graduation - in occupations for which training was received.	6	5	11	17	35	8	4	5	5	7	4	108

Source: Office records Boys' Trade

a) The difference between the totals entered here and the totals entered under No. 1 is due to the school's practice of counting hold-overs as having already graduated. Work placement sheets, on the other hand, actually consider these hold-overs as not having received a diploma.

Table 25

WITI - CLASS OF 1964 - YEARLY ENROLLMENTS

Enrollments	Auto	Cabinet	Carpentry	Electrical	Machine	Painting & Decorating	Pattern Making	Plumbing	Printing	Sheet Metal	Welding	Drafting	Electronics	Mechanical Technology	Metals Technology	Totals
13th grade (1962-63)	4	4	4	6	12	4	1	4	4	1	3	32	16	19	7	121
14th grade (1963-64)	12	1	4	5	8	1	1	3	5	1	4	29	13	8	4	99
Graduating June 1964	12	1	4	5	6	1	1	3	5	1	3	24	12	8	4	90
Employed in occupation for which trained	7	1	2	4	6	1	1	3	4	1	4	23	9	4	1	71
Employed in Full-time job	10	1	2	4	6	1	1	3	4	1	4	23	10	4	2	76

Source: Office records of Boys' Trade and WITI

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